JANANY

JOURNAL OF THE AMERICAN NURSES ASSOCIATION – NEW YORK

The official peer-reviewed, international, scholarly journal of the American Nurses Association - New York (ANA-NY) dedicated to disseminating quality and rigorous research, evidenced-based and quality improvement initiatives, case studies and reviews or applications of research to improve nursing practice, education and health care policy.

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AMERICAN NURSES ASSOCIATION NEW YORK

Guidelines for Manuscript Submissions

Membership Requirements

At least one author must be a member of the American Nurses Association – New York (ANA-NY), preferably the first or second author. If the authors are not ANA-NY members, we encourage one of the authors to become a member. An author can also be a member of one of the constituent organizations of the ANA. Non-ANA-NY members may submit manuscripts on a case-by-case basis. Please reach out to us at journal@anany.org. Manuscripts accepted for publication will not incur any publication or processing fees.

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Manuscripts should follow the Publication Manual of the American Psychological Association (7th ed.).

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Data Presentation (Level 1)

Description of Respondents Technique (Level 2)
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20-30 years old. (Level 4)
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- Reviews [systematic, integrative or scoping]
- Evidence-based practice initiatives
- Case studies
- Quality improvement projects
- Commentaries on current issues and trends in nursing

Required Components of the Manuscript (use the electronic fillable form located under our Submission Page of our website (https://ananewyork.nursingnetwork.com/page/95232-submission)

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- Title of manuscript
- A listing of each author, including professional credentials, job titles, institutional affiliations (with full addresses)
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- Identification or the absence of some or all sources of funding
- Corresponding author's complete mailing address, email, and cell number (cell number will not be published)
- Acknowledgments (if applicable)
- Statement of Institutional Review Board/Ethical Approval

B. Abstract and Title Page (include the title of the manuscript only)

A STRUCTURED ABSTRACT must be included with all manuscript submissions. Each heading of the structured abstract should include 2-3 sentences. It must be brief, concise, and offer a clear articulation of each heading. The following sections are included in the structured abstract, or as applicable:

- Background: a short overview of what the article is about and its aims or goals
- Objective and/or Significance of the Study: Explain the hypothesis, research question, or relevance of the topic. What is its contribution to the knowledge base of nursing science?
- Methodology: Include the research site, study design, sampling, data gathering tools, and statistical tests used
- Results: Present a brief summary, analysis, and synthesis of the findings. Organize the summary in such a way that you are aligning the outcome with what you described in the Objective section of the abstract (loop back to the hypothesis or significance of the study or topic)
- Limitations (if any). Justify or explain the presence of limitation/s
- Conclusion and Recommendations – affirm the objective of your manuscript by highlighting your results and its applications to nursing. What are take away lessons from your research?
- Key Words: Provide 3-5 key words using MeSH Headings

C. Manuscript (This should only be the manuscript itself with the title on the top. No author identifiers or information that might give a hint as to who the author is. All tables, figures and pictures should appear after the References in individual pages, in clear Word format, NOT in any picture format or statistical software. If picture files are submitted, it needs to be in high-resolution or we will not accept it.)

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All tables must be in Microsoft Word format (.doc not .xls or .pdf), can be editable or re-sized. Tables must be text-based and contain no images or graphics. It is not permissible to use tabs or auto-formats. All tables meet the standards of the Publication Manual of the American Psychological Association (7th ed.). Table font should be Times New Roman, 10-point, and single-spaced. Number all tables consecutively throughout the manuscript and must be placed at the end of the manuscript. Identify placeholders within the text where you wish them inserted, e.g., <Insert Table 3 here>.

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Identify and acknowledge any source/s of funding in the Author Submission Form.

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All manuscript submissions are subject to a double-blind peer review process. The authors and reviewers' identities will remain anonymous. The number of reviewers will vary, but will usually be a minimum of two.

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All manuscripts accepted for publication will be subject to editing. JANANY reserves the right to edit all submissions to meet the editorial needs, requirements, style, and standards of the journal.

Ethical Guideline for Authors

The author submits a manuscript only to one journal at any one time. One cannot submit previously published papers. Use appropriate tests and measures for research data analysis and interpretation. JANANY has the right to request raw and actual data. All manuscripts submitted must be the original work of the author.

Author can acknowledge individuals who helped in the conduct of the research to a certain degree. All listed authors must have actively been involved and contributed in all the steps of the research process, from research conceptualization to the write-up of the final version of the manuscript.

** We appreciate the work that Purdue University Online Writing Laboratory (OWL) offers to the public and allowing anyone to be able to use their available services.*

Journal of the American Nurses Association - New York (JANANY)

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From the ANA-NY President's desk: Another historical milestone for our organization

https://dx.doi.org/10.47988/janany.28235881.1.1

MARILYN L. DOLLINGER, DNS, FNP, RN
President, ANA-NY
2020 – 2022

Welcome to the first edition of the American Nurses Association of New York (ANA-NY) Open Access Journal. Congratulations to Edmund J. Y. Pajarillo, PhD, RN BC, CPHQ, NEA BC, ANEF, the first Editor-in-Chief and the entire editorial board and staff for this achievement.

The Journal of the American Nurses Association–New York (JANANY) is a peer-reviewed, international, open access journal that will encourage the dissemination of scholarship for members and non-members around the world. The importance of scholarship and evidence-based practice in guiding our practice is reinforced by the opportunities for both in this new journal.

I encourage all of you, in all spheres of nursing practice, research, and education, to take advantage of this member benefit to share the valuable work that you and your colleagues are doing. Spread the word among students and colleagues that JANANY is here and ready to go! Make a point of reviewing the journal articles regularly to learn about innovations in practice, new knowledge from research, and insights into education for the workforce of the future.

We are proud of this latest accomplishment from ANA-NY members. Well done!

The editor's vantage point: The historical grit of nurses

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Edmund J. Y. Pajarillo, PhD, RN BC, CPHQ, NEA BC, ANEF
Editor-in-Chief

We have heard many testimonials from a variety of patients, fellow healthcare professionals, co-workers, family and friends that nurses are hard-working, trustworthy, caring, resilient, knowledgeable, self-sacrificing and patient-centric. Every time we hear someone speaking about nurses in this vein, we cannot help but stand tall and proud that we are in the company of the best and truly remarkable group of professionals. These compliments are not new and have been resonating globally for many decades now. Negative comments we hear about nurses are few, isolated and an aberration from the many who epitomize the goodness and professionalism of nurses.

This is the 19th year that the nursing profession continues to be ranked by the Gallup Poll as the most trusted and ethical among all professions (Reinhart, 2020). The World Health Organization named the year 2020 as the "Year of the Nurse and Midwife". The year 2020 also marked the 200th year birth anniversary of Florence Nightingale, considered the founder of modern nursing (Rushlau, 2020). And what a year it was to honor nurses and midwives! The novel coronavirus (COVID-19) descended upon us, and a year later, it continues to wreak havoc to now millions of lives all over the world.

Nurses and other healthcare professionals treat and manage the health needs of many patients involved in all types of unexpected and catastrophic emergencies and disasters, e.g. mass shootings, natural calamities, epidemics and pandemics, terrorist casualties, daily motor vehicular pile-ups, rise in chronic illnesses and communicable diseases, etc. Working on the frontlines is not unusual for us. It is not surprising, therefore, that during this pandemic, nurses and other healthcare professionals are again battling this ferocious virus that continues to plague the world. Even in the midst of adversities, i.e., shortage of personal protective equipment, mechanical ventilators, the complexities of the COVID-19 virus, deteriorating mental health resulting from the surge of and persistent mortalities, we continue to thread along. Yes, it is excruciating. Yes, it is mentally, emotionally and physically challenging; but continuing to work our day beyond our regular working hours became the norm for us.

One would think that the horrific experiences we face on a daily basis would deter us from continuing on with our vocation. While it is true that some have retired when COVID-19 hit, it was more for self-preservation which we are not known for. Our colleagues were some of the pandemic's earliest victims, and most of those who passed away were those beyond 60 years of age, have chronic and compromising health conditions, and immune systems that have met the wear and tear of years of working as a nurse.

There are many reports that some of those who retired eventually came back to the workforce to help with the dire shortage of nursing staff who are overwhelmed with the number of COVID patients (Buppert, 2020; Jividen, 2020; Thompson, 2020). We also know of newly-minted nurses who fearlessly

accepted jobs as soon as they finished their schooling (Rutgers, 2020), sans the usual celebration of graduation or the required license to practice nursing.

Even technology, after having taken over every aspect of our lives, is not at par with dealing with the pandemic. The nature of COVID-19 is multifarious for technology to even catch up with. Contact tracing of potentially exposed individuals is a challenge even with the use of technology. Testing comes in various forms, accuracy, purpose, and availability (U.S. Food & Drug Administration, 2020). In the midst of all these are the misinformation and disinformation that add to the confusion of what to believe in, because of not being able or one's inability to vet the information properly.

Yet, nurses continue to care for the growing number of COVID-infested patients and those who are seriously compromised. Working long stretches of days lead us to experience mental distraught, some reaching the point of PTSD.

Despite these conditions in healthcare, prospective students continue to enroll in nursing schools (Assessment Technologies Institute, 2020). There is evidence of a 10% - 15% rise from the usual average of applications to enter nursing schools. Of course, the usual concerns pre-COVID continue to exist, e.g., limit in the number of admissions for lack of resources, decreased number of qualified faculty and diminished availability in clinical placement sites. Because of the pandemic, clinical sites are deliberately decreasing student placements to avoid overcrowding in patient care units.

If we do not take the lead in coursing the direction of nursing, the circumstances that we are currently faced with will dictate what our future will be. We are the members of this nursing community. We have the knowledge, skills and attitude to mold the future of nursing. And we rightfully should forge and write the envisioned "new" nursing.

We have the capability to think of innovations that will work for us and our patients. Throughout our education, critical and creative thinking have always been instilled in us. Having the foundational nursing knowledge and skills, the understanding of the health-illness continuum, and the social determinants of health, we can think of many ways to translate our soft skills and develop new but relevant roles. Re-envisioned roles that use concepts in informatics, innovation, data analytics, population health, interpersonal relationships, crisis intervention, interprofessional collaboration, and of course, research and evidence-based practice.

Scholarly work is never complete without disseminating results to our colleagues for practice translation, application, and consumption. Since the inception of the American Nurses Association - New York (ANA-NY) in 2012, our members have been clamoring for an academic journal to serve as the repository and source of scholarship and recent research. More and more scholarly work is being done with the increasing number of nurses obtaining either the PhD (one who conducts original and significant contribution to a body of knowledge in a particular field) or the practice or professional doctorate (one whose interest is in the practical application of knowledge in a practice setting). One of the goals of the Institute of Medicine – Robert Wood Johnson initiative, *The Future of Nursing: Leading Change, Advancing Health* (2011), is to double the number of nurses with doctoral degrees by 2020. The Doctor of Nursing Practice (DNP) doctorate is now being offered in all 50 states and the District of Columbia. There are 348 DNP programs with another 98 new applications as of 2019 (AACN, 2019). Between nurses with PhDs and DNPs, there are now 38,520 in 2018 as compared to only 1,814 in 2010 (AARP, AARP Foundation and RWJ Foundation, 2020).

Like any new organization, one can only accomplish as much. In the summer of 2020, the ANA-NY Board of Directors (BOD) approved the proposal to establish the Journal of the American Nurses Association – New York (JANANY). ANA-NY is the only constituent member of ANA that, so far, will have its own peer-reviewed open access journal that meets the organizational goal of "fostering high standards of nursing and promoting the professional and educational advancement of nurses to improve health care for all." It is an add-on benefit to its members. Since it is open access, original research, reviews, quality and evidence-based initiatives, case studies and contemporary commentaries will be readily available to all.

ANA-NY has grown in leaps and bounds since its establishment in 2012. It is our hope that JANANY will be the mechanism for the coming together of research consumers, research translators and knowledge discoverers to collaborate and increase the body of knowledge of nursing science. This is one way we can primarily influence the direction of our future. If we do not grab the bull by its horn, we will always be told what roles we will be able to do. We do not want that, do we? We know what is good for our patients and for us! Knowing that nurses have grit, we know we will prevail.

We encourage all nurses, whether members or non-members of ANA-NY to examine the journal and the original research that we publish, and validate, replicate, or challenge its findings to develop new knowledge. We envision a future of increasing collaboration on innovations and future directions. We see our future where more nurses will be conducting original, application and translational research to enhance nursing practice, education, and administration.

Summary Table

Number of people receiving nursing doctoral degrees annually (AACN, 2019)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
DNP	1,282	1,595	1,858	2,443	3,065	4,100	4,855	6,090	7,039	**32,327**
PhD	532	601	610	628	743	709	773	796	801	**6,193**
Total	1,814	2,196	2,468	3,071	3,808	4,809	5,628	6,886	7,840	**38,520**

Finally, this journal would not be possible without the belief and support of the 2020 ANA-NY BOD and staff. We also immensely thank the inaugural U.S. and international editorial advisory board, *JANANY* staff, and our contributors and peer reviewers who took the first step to allow us to begin our mission. We have lined up an excellent array of original research on various topics and a commentary on publishing your research successfully, in the hopes that we can encourage others who are waiting in the wings to submit your manuscripts to *JANANY*. This initiative is another manifest proof to the grit of nurses.

We, at *JANANY* and ANA-NY, are excited about this new initiative. We hope you are too!

References

AACN. (2020). PhD education. https://www.aacnnursing.org/Nursing-Education-Programs/PhD-Education.

AACN (March, 2019). DNP fact sheet. https://www.aacnnursing.org/News-Information/Fact-Sheets/DNP-Fact-Sheet.

AARP, AARP Foundation and RWJ Foundation The Future of Nursing: Campaign for Action. (January 2020). Campaign for progress dashboard. https://campaignforaction.org/about/.

Buppert, C. (2020). Coming out of retirement during a pandemic -- Is it possible? https://www.medscape.com/viewarticle/927235

Institute of Medicine (US) Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, at the Institute of Medicine. (2011). *The Future of Nursing: Leading Change, Advancing Health*. National Academies Press.

Jividen, S. (2020). These 4 nurses came out of retirement to help the frontlines (1 was trained by her son). https://nurse.org/articles/nurses-left-retirement-to-help-frontlines-covid19/

Reinhart, R. J. (2020). Nurses continue to rate highest in honesty, ethics. https://news.gallup.com/poll/274673/nurses-continue-rate-highest-honesty-ethics.aspx

Robert Wood Johnson Foundation – Institute of Medicine Report. (2010). The future of nursing: Leading change, advancing health. National Academies Press.

Rushlau, K. (2020). WHO names 2020 "Year of the Nurse and Midwife". https://www.integrativepractitioner.com/patient-care-planning/news/2020-01-03-who-names-2020-year-of-the-nurse-and-midwife#:~:text=Katherine%20Rushlau&text=The%20World%20Health%20Assembly%20of,the%20founder%20of%20modern%20nursing.

Rutgers School of Nursing. (2020). Rutgers Nursing to graduate BS in Nursing students early. https://nursing.rutgers.edu/news/rutgers-nursing-to-graduate-bs-in-nursing-students-early/#:~:text=Rutgers%20School%20of%20Nursing%20announced,students%20entering%20the%20health%-20professions.

Thompson, T. (2020). Health care workers pushing off retirement to help fight the pandemic. https://www.waff.com/2020/12/07/health-care-workers-pushing-off-retirement-help-fight-pandemic/

U.S. Food and Drug Administration, (2020). Coronavirus disease 2019 testing basics. https://www.fda.gov/consumers/consumer-updates/coronavirus-disease-2019-testing-basics

ORIGINAL RESEARCH

Evidence-based Nursing Practice in New York State: A Delphi Study

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Abstract

Background. Today's landscape of population health, economics, and educational delivery methods have influenced the progress and implementation of nursing practice built on the best evidence. International literature has documented barriers to implementing and sustaining evidence-based practice (EBP).

Purpose. The purposes of this study were to (a) identify barriers to implementing evidence into clinical practice in New York State (NYS), (b) prioritize resources needed to address these barriers, and (c) determine how the Cathryne A. Welch Center for Nursing (CNR) of the Foundation of NYS Nurses might provide support to address the identified barriers.

Methodology. Using a modified Delphi technique, a sample of nurse leaders completed two online survey rounds. The first Round provided qualitative feedback, which was categorized via content analysis, with a second Round that asked respondents to rank the categories from Round I.

Results. Organizational culture, productivity demands, and time were ranked as the top three barriers to implementing EBP in NYS. Time, leader support, and guidance/mentoring were identified as top resources needed to employ EBP. Respondents reported the CNR could facilitate EBP through financial support, communication, and mentoring. Data stratification revealed differences between rural and urban respondents, academic and clinical respondents, and geographical regions of the State, and differences in resources and support needed.

Conclusion. Findings confirm barriers for NYS nurses mirror those described in the literature. Resources and support needed, however, may be demographically specific. Awareness of these differences will enable the CNR to best support NYS nurses' implementation of EBP across the State.

MeSH Keywords: Nursing, Delphi Technique, Evidence-Based Practice, Barriers to EBP, Resources for EBP

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Conflict of Interest: The authors declare no actual or potential conflict of interest.

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Evidence-based Nursing Practice in New York State: A Delphi Study

Over the last two decades, a challenging landscape of population health, healthcare economics, and educational delivery has influenced the progress and continued implementation of sound nursing practice built on best evidence. Evidence-based practice (EBP) is a problem-solving approach to patient care that embodies the best evidence coupled with clinicians' knowledge, patient evaluations, and practice data with patient preference to drive decision making (Melnyk & Fineout-Overholt, 2015; Melnyk et al., 2012). Evidence implementation is an essential aspect of contemporary nursing practice. Institutions with effective structures for finding and implementing quality evidence demonstrate improved patient outcomes (Levin et al., 2016; Melnyk et al., 2017; Ryan-Madonna et al., 2020), reduced costs (Melnyk et al., 2016), and greater nursing satisfaction (Kim et al., 2017). Despite these documented benefits, there are barriers to implementing and sustaining EBP (Hasanpoor et al., 2019; Klimek Yingling, 2020; Melnyk et al., 2020; Warren et al., 2016).

Frequently cited barriers of EBP include a lack of resources (e.g., personnel, time, and library search availability), low engagement, and lack of enthusiasm (Dogherty et al., 2013). These obstacles are likely to remain if nursing leaders are not actively involved in creating realistic solutions. Historically, the Foundation of New York State Nurses Cathryne A. Welch Center for Nursing Research (CNR) has helped nurses promote EBP. The CNR identified the need to assess current barriers and needs as essential to promoting evidence-based practice. Fostering evidence-based nursing practice includes identifying and mitigating potential and tangible obstacles to best practice. Little research has been conducted on the barriers specific to NYS nurses.

Discussion with the CNR Steering Committee, representation from the Foundation Board of Directors, and ANA-NY Executive Director led to the strategic approach to collect more data on NYS clinical agencies' needs to move evidence-based practices forward. Therefore, the purposes of this study were to identify current barriers to implementing evidence into clinical practice in New York State, prioritize the resources needed to address these barriers, and determine ways that the Foundation of New York State Nurses' CNR can provide support to address identified barriers.

Literature Review

Nurses play a critical role in the quality of healthcare provided (Smiley et al., 2018). EBP is recognized as an essential aspect of contemporary professional nursing practice that fosters high-quality patient care. Compared to care grounded in tradition, EBP improves healthcare quality and safety and promotes improved patient outcomes, including lower morbidity and mortality and higher patient satisfaction (Melnyk & Fineout-Overholt, 2015; Melnyk et al., 2016). In addition, EBP lowers healthcare costs and fosters health care providers' professional satisfaction (Välimäki et al., 2018).

Despite significant benefits and the plethora of evidence available to inform and improve patient care, research indicates that EBP is not implemented consistently by health care professionals, including direct care nurses and nurse leaders (Harding et al., 2014; Melnyk et al., 2016; Melnyk et al., 2020; Warren et al., 2016;). Previous research over the last two decades, across practice settings in the United States and internationally, revealed multiple interrelated barriers to EBP, including: a) lack of EBP knowledge and competencies, b) lack of EBP mentors, c) organizational cultures and work environments that do not support EBP, d) demanding patient assignments, e) inadequate time and resources to search for and evaluate evidence, f) lack of expectations and organizational mandates to implement evidence-based care, g) volume of new knowledge disseminated in professional journals, h) pressure to maintain the status quo, and i) leader/manager resistance (Duncombe, 2018; Harding et al., 2014; Melnyk & Fineout-Overholt, 2015; Melnyk et al., 2012; Melnyk et al., 2016; Melnyk et al., 2020). Conversely, features that foster EBP include: a) beliefs that EBP improves patient care and outcomes, b) EBP knowledge and skills, c) education in research methods, d) expert support and mentoring, e) a supportive culture including those from interdisciplinary colleagues, f) evidence-based organizational policies and protocols, and g) leaders and managers who support and role model EBP (Bianchi et al., 2018; Duncombe, 2018; Melnyk et al., 2012; Melnyk et al., 2016).

Bianchi et al. (2018) postulated that clinicians' implementation of EBP depends on a supportive organizational culture led by leaders and managers who encourage and role model EBP. However, Melnyk et al. (2016) revealed that while nurse leaders expressed positive beliefs about EBP, their application of EBP in their organizations was often low. Nursing leaders have been called upon to transform contemporary healthcare practices and systems to make healthcare decisions based on the best available evidence (Melnyk et al., 2020).

Clinicians' perspectives about key facilitators of EBP include EBP knowledge and skills, support from interdisciplinary colleagues, and support from leaders and managers who role model EBP. Previous research also advanced nursing knowledge about the persistence of multiple barriers to EBP. Few studies, however, focused on chief nursing officers' and other clinical leaders' perspectives regarding barriers to implementing EBP or resources needed to mitigate existing barriers and establish EBP within healthcare systems. Additionally, there is scant qualitative work focusing on nurse leaders' perspectives on barriers and resources regarding EBP. This study addresses this gap in the current literature regarding nurse leaders' perspectives in NYS and the resources they view as necessary to implement evidence-based practices in their organizations.

Method

Design

A modified Delphi technique (McPherson et al., 2018) was used to gain consensus from a purposive sample of nurse leaders on barriers to implementing EBP in clinical settings, resources needed to address those barriers, and ways that the CNR might provide support. The Delphi technique is an adaptable research

method used to reach consensus among a group of experts through repetitive rounds of two to three surveys (Hasson et al., 2000; McPherson et al., 2018). Round I of the survey used open-ended questions to obtain participants' perspectives about the research questions. After the initial results were obtained, the research team analyzed the data and identified categories. In Round II, participants were asked to rank categories based on their views and priorities in achieving EBP in clinical settings. Participants were provided with a list of categories with exemplar statements that explained the categories' meaning based on the Round I participants' responses. This will be further delineated in the results.

Sample

Purposive sampling was conducted from a target population of registered professional nurses in NYS with self-identified expertise in EBP and responsibility for leading or facilitating change in clinical practice arenas. Additionally, participant eligibility requirements included a minimum of an earned bachelor's or graduate degree in nursing, or a bachelor's degree in nursing and a graduate degree in a relevant field, e.g., administration, informatics. The target goal was fifty participants with broad geographical representation, rural and urban/suburban, and position distribution across NYS.

Participants included clinical practice leaders, Magnet/Pathway to Excellence coordinators, nurse administrators, nurse consultants, and faculty members responsible for teaching EBP courses and mentoring students' EBP/quality improvement projects at all nursing education levels. Settings included: tertiary care, managed care, home care, ambulatory care, assisted living, long-term care, hospice, palliative care, and community care organizations. Participants were recruited through co-investigator professional networks and relationships. Letters describing the study purpose and expected time commitment for participation were sent electronically to potential participants.

Ethical Considerations

The Institutional Review Board at Utica College approved the study. All participants were over 18 years of age, with no exclusions based on age, gender, race, ethnicity, or sexual preference. Co-investigators conducting analysis did not have access to Round I participants' identifiable information and deleted any identifiable information from Round II data before analysis began. To ensure participants' confidentiality, at least four participants had to be included in a sub-group to analyze demographic break-outs. No funding was obtained for this study. No compensation was provided to the participants at any stage of the research.

Data Collection

Data were collected electronically using Cvent survey software (www.cvent.com, McClean, VA, USA). Cvent is a survey and feedback management platform designed to enable organizations to connect with members through email surveys. Participants were invited to participate in the survey by email with a link that captured data directly in Cvent. Reminder emails were sent directly from Cvent to all participants for both rounds, with two reminder emails sent for each Round. Initially, for Round I, four weeks were allotted to collect data after the survey was launched. Unfortunately, this timeframe coincided with the peak of the COVID-19 pandemic in NYS. Due to the severity of the pandemic and the significant role of nursing during this time, an additional four weeks were added for data collection.

In Round I, participants were asked to provide demographic data and provide short-answer narrative responses to the following questions:

1. What do you perceive as the three major barriers to implementing evidence into practice in your clinical agency?
2. What do you believe are the three most important resources needed to escalate the implementation of evidence into clinical practice?
3. How do you believe the Foundation of NYS Nurses Cathryne A. Welch Center for Nursing Research can help support efforts to implement evidence into practice?

As described below, Round I data were analyzed to develop categories with exemplar quotes to be sent to participants for ranking in Round II.

For Round II, final categories with exemplar quotes from Round I were sent to participants by email with a link to the Cvent database. Participants were instructed to rank each category's importance, with one being most important for addressing the question at the participant's agency or institution. Participants were again asked to provide demographic information. Additionally, those who responded in Round I were asked whether they thought their responses were adequately reflected in Round II categories.

Data Analysis Procedures

For each Round, survey responses were downloaded into Excel spreadsheets and forwarded to co-investigators conducting the analysis. Descriptive content analysis of Round I open-text narrative responses was conducted to synthesize participant statements into categories of like responses. Each category identified a central theme reflecting individual statements. The data were independently analyzed in teams of two initially for each question. Four co-investigators discussed and analyzed the data until consensus was reached.

For analysis of Round II data, co-investigators first looked at responses to the question asking whether participants thought categories from Round I data accurately and adequately reflected their narrative responses. Investigators then analyzed the ranking of categories for each question using medians and modes to determine aggregate ranks for the total sample as well as for participants grouped by demographic categories for the primary role (clinical or academic), location of setting (rural or urban/suburban), and geographic region of NYS (downstate, northeast, central, or western). Round II data were analyzed with descriptive statistics. For each question, a summary ranking of categories was determined first by looking at median scores, second by looking at the number of participants who scored that category as one of the top three, and lastly by looking at the number of participants who scored that category as among the two or three least important. Given the small sample size and consensus among participants after Round II, investigators determined that a third-round was not needed.

Results

In Round I, of 88 surveys sent, 24 surveys were returned for an initial 27% response rate. Three surveys were eliminated, two from non-RNs, and one from a nurse who stated no involvement in EBP, leaving a usable response rate of 22%. Among the 21 participants whose responses were included in Round I analysis, 11 provided complete responses, 18 responded to one or more questions about clinical barriers, and 14 responded to questions about resources needed and ways the CNR could support EBP. In Round II, 17 participants responded out of 69, yielding a 25% response rate. Four of the 17 participants did not participate in Round I; however, their responses were included in the analysis.

In Round I, the nurse leaders were asked how they influence EBP in their practice. This question was a select all-that-apply item. The nurse leaders (n=18) reported that they: Guide nurses to integrate EBP in their clinical role (14), Guide nursing students to integrate EBP in their clinical role (10), Collect evidence to inform EBP (9), and Lead integration of EBP in an agency (8). The majority of nurse leaders who completed Round II (n=17 [70.6%]) reported a doctoral level nursing degree as their highest attained degree. Three participants (17.6%) reported a masters-level as their highest nursing degree. Two participants (11.8%) reported a doctoral-level degree in a field other than nursing as their attained highest degree. The majority of participants in Round II reported their primary roles as CNO in agency or institution (n=17 [29%]), Conducts/guides EBP projects or research in a practice setting (18%), and EBP educator for clinical RNs or RN students (41%). The practice locations in Round II were reported as urban/suburban downstate, urban/suburban central, rural central, urban/suburban northeast, rural northeast, and urban/suburban western. No participants indicated they were from rural downstate and rural western NY in Round II. Demographics for participants of Round I and Round II are displayed in Table 1.

Table 1

Participants' Demographics for Rounds I and II

Demographic category		Round I (n=18)	Round II (n=17)
Highest earned nursing degree	Baccalaureate	--	--
	Masters	3	3
	Doctorate	15	12[b]
Primary role (select all that apply) [a]	CNO in agency or institution	3	5
	Completed EBP project in grad school	1	1
	Conducts/guides EBP projects or research in a practice setting	5	3
	EBP educator for clinical RNs or RN students	5	7
	Clinically based EBP leader	--	1
	Other: Round I: research, DON, acad. CAN; Round II: vice dean, provost	4	2
How you impact EBP in your practice (select all that apply) [this asked only in Round I]	Lead integration of EBP in an agency	8	--
	Guide nurses to integrate EBP in their clinical role	14	--
	Guide nursing students to integrate EBP in their clinical role	10	--
	Collect evidence to inform EBP	9	--
	Oher: support, RCA process	2	--
Practice location in NYS	Urban/suburban downstate	1	4
	Rural downstate	--	--
	Urban/suburban central	4	4[c]
	Rural central	1	2
	Urban/suburban northeast	7	3
	Rural northeast	1	2
	Urban/suburban western	3	2
	Rural western	1	--

[a] Each participant chose only one response in Round I; one chose three in Round II.

[b] one participant chose two locations; 1st recorded;

[c] two additional participants chose doctorate in another field

A descriptive content analysis of barriers evaluated open-text narrative responses from Round I revealed eight categories describing roadblocks to implement EBP (Table 2). The top barriers were time to implement EBP, practicing nurses' lack of knowledge about EBP, professional role formation, organizational culture/environment, academic preparation of students/graduate nurses, productivity demands, competing paradigms, and resources.

Table 2
Top Clinical Barriers to Implementing EBP

Categories	Supporting Quotes
Time to implement EBP	• *The actual time to implement evidence-based new practices.* • *Frontline staff having dedicated time for EBP at the clinical bedside*
Practicing nurses' lack of knowledge about EBP	• *Knowledge and understanding of how EBP strengthens practice* • *Access and skill in critiquing the evidence, i.e., research-based articles, manuscripts, reports* • *Lack of understanding of the impact of not using EBP*
Professional Role Formation	• *Staff engagement, failure to see the connection to practice* • *Influencing clinical nurses to be open to changes in practice based on evidence.* • *Making nurses aware of their autonomy and ability to institute evidence-based practice techniques* • *Nurses feeling competent to initiate and champion change in practice along with*
Organizational Culture/ Environment	• *Resistance to change* • *Lack of buy-in from nursing staff* • *Availability of resources to support evidence for best practices* • *Leaders supporting and empowering clinical nurses to lead change*
Academic Preparation Students/ Graduate Nurses	• *The lack of emphasis of EBP in the educational preparation of new nurses; specifically, integration into every course throughout the curriculum* • *At the associate level, there is a lack of time in the curriculum to devote to developing EBP and research skills.*
Productivity Demands	• *Productivity demands on nurses* • *Dedicated time and resources for the actual implementation of the EBP change.* • *The clinical practice setting is so busy caring for patients that the clinicians do not engage in thinking outside of their "normal" practices.*
Competing Paradigms	• *Lack of awareness of its role amongst other nursing leaders and front line staff* • *The organization is financially cautious. If the implementation will increase expense, there can be resistance* • *Inconsistent support from leadership to embrace EBP...do not walk the talk nor talk the walk*
Resources	• *Availability of resources to support evidence for best practices* • *Time, organization's allocation of resources*

The analysis identified nine categories from participants' responses to resource needs (Table 3). The three most important resources for implementing EBP were time, point of care expertise, and skilled guidance/mentors.

Table 3
Three most important resources for implementing EBP

Key Concept/ Word	Supporting Quotes
Time	• *Dedicated time for staff to engage in EBP/Research activities* • *Facilitating the time for nurses to seek new evidence*
Point of care (POC) expertise	• *Engagement in changing practices from the front line* • *Place mentors in key areas or service lines to support point of care EBP integration* • *NURSE SCIENTIST on site*
Skilled guidance/ mentors – academic & clinical	• *EBP mentors for academics and new nurses* • *Tight college and clinical site integrations* • *Skilled guidance into interpreting and critiquing research*
Organizational support/structure	• *Financial business case for EBP* • *Time provided by employers for research and writing* • *Practice settings demonstrating the value of best evidence via awards, rounds, presentations, etc.* • *Providing structures for nurses to explore evidence & change practice* • *Need for appropriate staffing levels to allow time for education and thoughtful application of best practices*

Evidence/ resources – accessible, relevant, robust	• *Ease of access (able to be downloaded on cellphones* • *The robustness of resources (…are they juried/vetted)* • *Making statistics clinically meaningful* • *Access to research* • *Robust databases & library resources for nurses* • *Rich library resources with easy access*
Common language	• *Standardized educational tools* • *EBP Model* • *Need for a common language, i.e., staff nurses don't recognize QSEN*
Leader support	• *Leadership setting the example through use of credible evidence in practice—regardless of specialty—and engaging faculty, staff, and other leaders in EBP projects* • *Leaders that support EBP and empower nurses to share ideas and be creative*
Teams	• *Cohesive team and resources to develop/integrate EBP practice* • *Research teams*
Knowledge/ competence	• *Nurses at ALL levels of practice need to be fully immersed and be knowledgeable of EBP processes* • *Competence interpreting/critiquing research findings*

Lastly, five categories emerged from the analysis of responses to suggest how the CNR could support EBP implementations in participants' agencies (Table 4). These were financial support/ grants and scholarships, communication/visibility/dissemination, getting buy-in, educational tools/resources, and mentoring.

Table 4
Top Three Ways the CNR Can Help You Implement EBP

Key Concept/ Word	Supporting Quotes
Financial support/grants/ scholarships	• *Support nursing research through scholarships* • *Grants for faculty* • *Grants to support pilot projects* • *Funding opportunities*
Communication/ visibility/ dissemination	• *…venues for sharing research outcomes etc.* • *Greater visibility/connection at all levels of nursing practice* • *Make your resources more well-known (PR)* • *Give nurses and student nurses an avenue to broadcast their evidence-based strategies* • *Awards* • *Encourage dissemination of nursing research* • *Provide a venue for educators and service folks to come together to close the EBP application gap…this requires knowing how to manage change in real point-of-care situations*
Getting buy-in	• *Education to Sr Team members of the value investing in such education will improve patient outcomes and reduce mortality* • *Giving them the "what's in it for me"*
Education: tools & resources	• *Provide educational opportunities for RNs to develop EBP skills, especially for the AD-level RNs* • *Increase the ease of access (ability to access during class or clinical)* • *Programs to support EBP that are accessible and affordable* • *Repository of EBP tools* • *Offering a toolkit for each stage of the process to assist users* • *Offering short webinars to educate or remind nurses ho to perform EBP – relate to toolkits*
Mentoring	• *Support from experts in the field to local hospitals* • *Resource pooling/mentoring—perhaps one-on-one guidance* • *Set up a mentor network with clinical research skilled specialists* • *Publication support*

All 17 participants responding in Round II completed the ranking of all categories from Round I. (Please note that all rankings, regardless of the number of categories, considered "one" as most important.) Participants who indicated they also had responded in Round I noted that the categories accurately and adequately reflected their earlier input. Two participants, however, commented that they were not certain or could not recall. Given the relatively small number of categories for each question, participants were asked to rank all categories rather than ranking only their top three. Round II ranking results were multi-modal, and medians were used in some cases. Rural versus urban/suburban and geographical location demographics were separated, so data could be aggregated to include at least four

participants in a sub-group. Because Western NYS only had two participants, those data are not displayed in the tables. However, data from participants from Western NYS were included in the total rankings and non-geographic specific break-outs. Table 5 identifies the eight barriers to EBP which emerged from Round I with exemplars and their rank order. Participants ranked the top three categories: organizational culture/environment, productivity demands, and time to implement EBP.

Table 5
Round II Ranking of Clinical Barriers to Implementing EBP by Participants in Total and by Demographic Sub-group

Barriers to implement EBP	Time to implement EBP	Practicing RNs' lack of knowledge about EBP	Professional role formation	Org. culture/ environment	Academic prep of students/ graduate RNs	Productivity demands	Competing paradigms	Resources
Total n=17	3	5	8	1	7	2	6	4
Rural (n=4)	4	5	8	1	3	2	7	6
Urban/ Suburban (n=13)	3	5	8	1	7	2	6	4
Clinical (n=8)	4	5	8	2	7	1	6	3
Academic (n=9)	3	4	8	1	7	2	6	5
Central (n=6)	3	5	7	1	6	4	8	2
Northeast (n=5)	3	4	8	2	7	1	5	6
Downstate (n=4)	2	6	8	1	7	3	5	4

Note: categories ranked with 1= most important

Participants also ranked the nine categories identified as resources needed to implement EBP. Table 6 presents these results by the total number of participants and by demographic sub-group. The top three resources needed were time, leader support, and skilled guidance/mentors.

Table 6
Round II Ranking of Resources Needed to Implement EBP by Participants in Total and by Demographic Sub-group

Resources needed to implement EBP	Time	Point of care expertise	Skilled guidance/ mentors (academic /clinical)	Org. support/ structure	Evidence/ resources accessible, relevant, robust	Common language	Leader support	Teams	Knowledge/ competence
Total n=17	1	6	3	4	7	9	2	8	5
Rural (n=4)	3	4	2	6	8	9	1	7	5
Urban/Suburban (n=13)	1	7	4	2	6	9	3	8	5
Clinical (n=8)	1	6	3	4	7	9	2	8	5
Academic (n=9)	4	7	1	2	5	9	3	8	6
Central (n=6)	1	6	3	5	7	9	2	8	4
Northeast (n=5)	1	6	3	4	8	9	2	7	5
Downstate (n=4)	2	8	4	1	5	9	3	7	6

Note: categories ranked with 1= most important

Finally, participants ranked the nine categories identified as assistance from the CNR (see Table 7) in the following order of importance: 1. Financial support/grants/scholarships, 2. Communication/visibility/dissemination, 3. Mentoring, 4. Educational tools and resources, and 5. Getting buy-in.

Table 7

Round II Ranking of Ways the CNR can Support EBP Implementation by Participants in Total and by Demographic Sub-group

Support from CNR	Financial support/ grants/ scholarships	Communication/ visibility/ dissemination	Getting buy-in	Education: tools & resources	Mentoring
Total n=17	1	2	5	4	3
Rural (n=4)	4	5	3	2	1
Urban/Suburban					
(n=13)	2	1	5	3	4
Clinical (n=8)	1	2	5	3	4
Academic (n=9)	2	3	4	5	1
Central (n=6)	2	4	5	3	1
Northeast (n=5)	1	4	5	2	3
Downstate (n=4)	2	1	3	4	5

Note: categories ranked with 1= most important

Discussion

The purpose of a Delphi survey is to reach a consensus among a group of experts about a research question. In this study, the findings represent the consensus of an expert panel of nurse leaders regarding the barriers to implementing EBP in clinical practice in New York State (NYS), the resources needed to overcome these barriers, and how the CNR might provide support to address identified barriers.

Barriers

In our sample, organizational culture and environment, productivity demands, and time ranked as the top three barriers to implementing EBP. Barriers reflected in the category of "organizational culture and environment" included resistance to change, lack of buy-in from nursing staff, resource availability to support evidence for best practices, and leaders supporting and empowering clinical nurses to lead change. Previous research also reported cultures and workplace environments that did not support EBP (Dalheim et al., 2012; Harding et al., 2014; Heydari et al., 2014; Melnyk et al., 2016; Wilson et al., 2015).

Participants identified organizational culture and environment as the first barrier to EBP. Not surprisingly, they also reported leader support as an essential resource to implement EBP. This finding is consistent with previous literature that underscored nursing leadership's influence on EBP (Bianchi et al., 2018; Hasanpoor et al., 2019). Transforming the workplace culture so that nurses' clinical practice is consistently grounded in evidence is a complex undertaking. Nurse leaders play a critical role in transforming the workplace culture to embrace EBP by orienting, educating, and mentoring new clinicians, providing education and mentoring for seasoned clinicians, and allocating necessary resources, including time (Bianchi et al., 2018; Melnyk et al., 2016). Consistent with previous literature, this study identified time as a crucial resource for implementing EBP (Crable et al., 2020; Pittman et al., 2018; Sidani et al., 2016). Barends et al. (2017) reported that lack of time was perceived as the most significant barrier to applying EBP in management. Crable et al. (2020) reported that practicing nurses identified time, limited knowledge, and resistance to change as barriers to practice EBP.

The study also reported productivity demands one of the top barriers to implementing EBP. The findings by Camargo et al. (2018) also identified a lack of knowledge for evidence evaluation, work overload, and resistance to change of practice as barriers. Work overload is multifaceted and may encompass productivity demands, time, leadership support, and organizational environment. Beyond nursing, Harding et al. (2014) found that allied health clinicians and managers viewed healthcare's rapid pace and maintaining patient flow as a higher priority than EBP. Harding et al. also found lack of time to be correlated with workload reported barriers to EBP: attitudes and expectations, resources, and lack of understanding of EBP.

Resources

Participants reported time, leader support, and "guidance and mentoring" as the top three resources needed to implement EBP. The barriers to EBP, and the resources needed to implement EBP, were inversely related to one another in several instances. For example, while time was reported as a significant resource, lack of time was also viewed as a top barrier to EBP. This finding is consistent with previous research (Alatawi et al., 2020; Melnyk et al., 2012; Renolen et al., 2018). Nurses need time to locate,

critically appraise, and implement evidence in practice (Melnyk & Fineeout-Overholt, 2015).

Participants also reported that leadership support was a critical resource to employ EBP and often drives decision-making in organizations. Managers and organizations have a unique position to promote an organizational environment that fosters appreciation and application of good evidence to decision making (Barends et al., 2017; Bianchi et al., 2018; Melnyk et al., 2016; Pittman et al., 2018). Leadership support has consistently been identified in the literature as essential to promote and sustain EBP. Melnyk et al. (2016) reported that organizational leaders hold EBP in high regard but have a low personal implementation of EBP; they report EBP was not a priority in their organization's fiscal budgets, are not clear about the steps of EBP, and lack the confidence to implement EBP properly.

Barends et al. (2017) reported that leaders believe EBP is relevant. However, when faced with problem-solving, they often look to personal experience, knowledge from formal education, and intuition rather than scientific evidence. Pittman et al. (2018) also postulated that "leaders" actions positively influence change and excellence in practice and create a supportive work culture. A focus on mentoring the mentor from an academic setting into practice may help promote the use of EBP by organizational leadership for decision making. Fostering EBP competency across the nursing trajectory may create a culture of EBP needed to improve healthcare quality.

Demographic variation

As addressed above, participants' consensus mirrored much of what the literature described. Closer examination of rank scores stratified by demographics revealed that participants' geographic location, work setting, and primary role were associated with differences that would not have been evident if only panel-level data had been examined. The most significant and most frequent differences in rank scores were found between rural settings and urban or suburban areas.

Academic preparation of students and graduate nurses was seen as the 3rd most important barrier to implementing EBP in rural settings. In contrast, academic preparation was ranked 7th, second from the bottom, by participants in urban or suburban settings. Given this difference in ranking of barriers, it is not surprising that rural participants ranked organizational structure and support as only 6th of 9 resources needed, while urban and suburban participants ranked organizational structure and support as the 2nd most crucial resource needed. Rural participants identified leader support and skilled guidance, and mentoring as their most needed resources (1st and 2nd, respectively). These differences were seen again in rank scores for how the CNR could help support the implementation of EBP, with rural participants ranking mentoring from the CNR as most important compared with a ranking second from the bottom (4th of 5 categories) by urban and suburban participants. Similar differences in ranks given to organizational structure and support and mentoring were found between participants in central and northeastern regions compared with those in downstate and western regions; however, these most likely were associated with more rural participants in central and northeast parts of NYS.

Differences in the ranking of resources needed for EBP and ways the CNR could support EBP implementation were also found between participants primarily in clinical roles compared with those primarily in academic roles. Both groups, however, scored productivity demands among their top two barriers to EBP implementation. For clinicians, time was the most important resource needed, whereas academically based participants ranked time as 4th of 9 categories. Academically based participants ranked mentoring as the most important way the CNR could support EBP implementation, whereas clinicians ranked mentoring as 4th of 5 possible categories.

Recommendations for the CNR

Respondents reported the CNR could facilitate EBP through financial support, "communication, visibility and dissemination," and mentoring. When examined by geographic regions, it was interesting that rural geographic regions sought mentoring, whereas urban and suburban areas sought communication, visibility, and dissemination. This finding may represent that rural areas have challenges different from their urban counterparts in exposure to clinical nurse specialists and graduate prepared nurses. Perhaps using current technology, the CNR may increase communication, visibility, and dissemination throughout NYS. The use of technology may also provide mentoring to a broader area where nurses do not have access to nursing leaders who are well versed in EBP.

Limitations of the Present Study

There are several limitations of this study. First, the low response rate and resulting small sample were most likely a consequence of launching the survey simultaneously with the first spread of COVID-19 across NYS. Second, unequal representation across regions limits the CNR's ability to identify the needs of all regions throughout NYS. Third, although every attempt was made to provide clear instructions for study participants, one conceptual issue arose throughout the final Delphi round regarding whether participants reviewed the exemplars to define each ranking item before ranking their selections. Lastly, some respondents did not participate in both rounds.

Conclusions and Future Prospects

This study's findings mirror those described in the literature examining primary barriers to implementing EBP in clinical settings. While resources and support are needed, they may be demographically specific. Awareness of these differences will enable the CNR to best support NYS nurses' implementation of EBP across the State in various demographic regions. The Delphi survey findings propose a preliminary list of resources and support needed that may contribute to increasing the implementation of EBP into clinical practice in NYS. As stated in the introduction, one of the main reasons the CNR decided to undertake this study was that findings would give direction to its strategic planning. Results indicated the three top-ranked ways that the CNR could help, i.e., through financial support, increasing "communication, visibility, and dissemination" of EBP, and mentoring, differing by geographic region and clinical or academic affiliation. The authors have already begun working on communication and

dissemination by writing this article and submitting abstracts to two well-known nursing organizations for possible presentation. The next steps are to explore ways to address the other support that is needed to enhance EBP in NYS.

As always, the more information that is available, the better the ability to decide how to move forward. Additional knowledge about nursing leaders' needs and abilities regarding their own EBP knowledge may be a key to better understanding how to support them. Also, a better understanding of the diverse needs of nursing leaders by geographic regions is needed. This study highlights the importance of collaboration between geographic regions, healthcare organizations, and leadership organizations within the State of New York to achieve our mutual goals for providing the best healthcare to all NYS citizens.

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References

Alatawi, M., Aljuhani, E., Alsufiany, F., Aleid, K., Rawah, R., Aljanabi, S., & Banakhar, M. (2020). Barriers of implementing evidence-based practice in nursing profession: A literature review. *American Journal of Nursing Science, 9*(1), 35-42. https://dx.doi.org/10.11648/j.ajns.20200901.16

Barends, E., Villanueva, J., Rousseau, D. M., Briner, R. B., Jepsen, D. M., Houghton, E., & ten Have, S. (2017). Managerial attitudes and perceived barriers regarding evidence-based practice: An international survey. *PLoS ONE, 12*(10), 1–15. https://dx.doi.org/10.1371/journal.pone.0184594

Bianchi, M., Bagnasco, A., Bressan, V., Barisone, M., Timmins, F., Rossi, S., Pellegrini, R., Aleo, G., & Sasso, L. (2018). A review of the role of nurse leadership in promoting and sustaining evidence-based practice. *Journal of Nursing Management, 26*(8), 918 - 932. https://dx.doi.org/10.1111/jonm.12638

Camargo, F. C., Iwamoto, H., Galvão, C., Pereira, G., Andrade, R., & Masso, G. (2018). Competences and barriers for the evidence-based practice in nursing: An integrative review. *Revista Brasileira de Enfermagem, 71*(4), 2030-2038. https://dx.doi.org/10.1590/0034-7167-2016-0617

Crable, J., Highfield, M., & Patmon, F. (2020). Evidence-based practice knowledge, attitudes, practices, and barriers. *Nursing Critical Care, 15*(5), 24-32. https://dx.doi.org/10.1097/01.ccn.0000694076.73284.a3

Dalheim, A., Harthug, S., Nilsen, R. M., & Nortvedt, M. W. (2012). Factors influencing the development of evidence-based practice among nurses: A self-report survey. *BMC Health Services Research, 12*, 367. https://dx.doi.org/10.1186/1472-6963-12-367

Dogherty, E. J., Harrison, M. B., Graham, I. D., Vandyk, A. D., & Keeping-Burke, L. (2013). Turning knowledge into action at the point-of-care: The collective experience of nurses facilitating the implementation of evidence-based practice. *Worldviews on Evidence-Based Nursing, 10*(3), 129-139. https://dx.doi.org/10.1111/wvn.12009

Duncombe, D.C. (2018). A multi-institutional study of the perceived barriers and facilitators to implementing evidence-based practice. *Journal of Clinical Nursing, 27*, 1216-1226. https://dx.dx.doi.org/10.1097%2FMD.0000000000017209

Harding, K., Porter, J., Horne-Thompson, A., Donley, E., & Taylor, N.F. (2014). Not enough time or a low priority? Barriers to evidence-based practice for allied health clinicians. *Journal of Continuing Education in Nursing, 34*(4), 224-.231. https://dx.doi.org/10.1002/chp.21255

Hasanpoor, E., Siraneh Belete, Y., Janati, A., Hajebrahimi, S., & Haghgoshayie, E. (2019). Nursing' managers' perspectives on the facilitators and barriers to implementation of evidence-based management. *Worldviews on Evidence-Based Nursing, 16*(4), 255–262. https://dx.doi-org.sunypoly.idm.oclc.org/10.1111/wvn.12372

Hasson, F., Keeney, F., & McKenna, S. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing, 32*(4), 1008-1015. https://doi.org/10.1046/j.1365-2648.2000.t01-1-01567.x

Heydari, A., Mazlom, S.R., Ranjbar, H., & Scurlock-Evans, L. (2014). A study of Iranian nurses' and midwives' knowledge, attitudes, and implementation of evidence-based practice: the time for change has arrived. *Worldviews on Evidence-Based Nursing, 11*(5), 325-31. https://dx.doi.org/10.1111/wvn.12052

Kim, S. C., Ecoff, L., Brown, C. E., Gallo, A. M., Stichler, J. F., & Davidson, J. E. (2017). Benefits of a regional evidence-based practice fellowship program: A test of the ARCC Model. *Worldviews on Evidence-Based Nursing, 14*, 90-98. https://dx.doi.org/10.1111/wvn.12199

Klimek Yingling, J. (2020). Rationing Evidence-Based Nursing Practice: Considering a Resource-Based Approach. *The Online Journal of Issues in Nursing, 26*,(1). https://dx.doi.org/10.3912/OJIN.Vol26No01PPT62

Levin, R. F., Wright, F., Pecoraro, K., & Kopec, W. (2016). Maintaining perioperative normothermia: Sustaining an evidence-based practice improvement project. *AORN Journal, 103*(2), 213-e1. https://dx.doi.org/10.1016/j.aorn.2015.12.020

McPherson, S., Reese, C., & Wendler. C. (2018). Methodology update: Delphi studies. *Nursing Research, 67*(5), 404–410. https://dx.doi.org/10.1097/NNR.0000000000000297

Melnyk, B.M. & Fineout-Overholt, E. (2015). Making the case for evidence-based practice and cultivating a spirit of inquiry. In *Evidence-based practice in nursing and healthcare: A guide to best practice* (3rd ed, pp. 3-23). Wolters Kluwer.

Melnyk, B.M., Fineout-Overholt, E., Gallagher-Ford, L., & Kaplan, L. (2012). The State of evidence-based practice in US nurses: Critical implications for nurse leaders and educators. *Journal of Nursing Administration, 42*(9), 410–417. https://dx.doi.org/10.1097/nna.0b013e3182664e0a

Melnyk, B. M., Fineout-Overholt, E., Giggleman, M., & Choy, K. (2017). A test of the ARCC model improves the implementation of evidence-based practice, healthcare culture, and patient outcomes. *Worldviews on Evidence-Based Nursing, 14*(1), 5–9. https://dx.doi.org/10.1111/wvn.12188

Melnyk, B. M., Gallagher- Ford. L., Thomas, B. K., Troseth, M., Wyngarden, K., & Szalacha, L. (2016). A study of chief nurse executives indicates low prioritization of evidence-based practice and shortcomings in hospital performance metrics across the United States. *Worldviews on Evidence-Based Nursing, 13*(1), 6–14. https://dx.doi.org/10.1111/wvn.12133

Melnyk, B. M., Zellefrow, C., Tan, A., & Hsieh, A. P. (2020). Differences between magnet and non-magnet-designated hospitals in 'nurses' evidence-based practice knowledge, competencies, mentoring and culture. *Worldviews on Evidence-Based Nursing, 17*(5),337-347. https://dx.doi.org/10.1111/wvn.12467

Renolen, A., Hoye, S., Hjälmhult, E., Danbolt, L., & Kirkevold, M.(2018). Keeping on Track - hospital nurses' struggles with maintaining workflow while seeking to integrate evidence-based practice into their daily work: A grounded theory study. *International Journal of Nursing Studies, 77*,179-188. https://dx.doi.org/10.1016/j.ijnurstu.2017.09.006.

Ryan-Madonna, M., Levin, R. F., & Lauder, B. (2019). Effectiveness of the teach-back method for improving 'caregivers' confidence in caring for hospice patients and decreasing hospitalizations. *Journal of Hospice & Palliative Nursing, 21*(1), 61-70. https://dx.doi.org/10.1097/njh.0000000000000492

Sidani, S., Manojlovich, M., Doran, D., Fox, M., Covell, C., Kelly, H., Jeffs, L., & McAllister, M. (2016). Nurses' perceptions of interventions for the management of patient-oriented outcomes: A key factor for evidence-based practice. *Worldviews on Evidence-Based Nursing, 13*(1), 66-74. https://dx.doi.org/10.1111/wvn.12129

Smiley, R.A., Lauer, P., Bienemy, C., Berg, J.G., Shireman, E., Reneau, K.A., & Alexander, M. (2018). The 2017 national nursing workforce survey. *Journal of Nursing Regulation, 9*(3), supplement (S1-S54). https://dx.doi.org/10.1016/S2155-8256(18)30131-5

Välimäki, T., Partanen, P., & Häggman, L. A. (2018). An integrative review of interventions for enhancing leadership in the implementation of evidence-based nursing. *Worldviews on Evidence-Based Nursing, 15*(6), 424-431. https://dx.doi.org/10.1111/wvn.12331

Warren, J. I., McLaughlin, M., Bardsley, J., Eich, J., Esche, C.A., Kropkowski, L & Risch, S. (2016). The strengths and barriers of implementing EBP in healthcare systems. *Worldviews on Evidence-Based Nursing, 13*(1), 15–24. https://dx.doi.org/10.1111/wvn.12149

Wilson, M., Sleutel, M., Newcomb, P., Behan, D., Walsh, J., Wells, J., & Baldwin, K. (2015). Empowering nurses with evidence-based practice environments: Surveying Magnet, Pathway to Excellence, and non-magnet facilities in one healthcare system. *Worldviews Evidence-Based Nursing, 12*(1), 12-21. https://dx.doi.org/10.1111/wvn.12077

ORIGINAL RESEARCH

Technology Use and Frailty for Community Dwelling Older Adults: A Scoping Review

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Abstract

Background: Frailty is a common geriatric syndrome defined as a state of increased vulnerability to acute stressors related to a decline in reserve. There is abundant literature on frailty interventions, however, the literature on technology as an intervention for frailty is scarce.

Objectives: The purpose of this scoping review is to identify and summarize existing evidence on technology use as an intervention for frail older adults and to identify research gaps in the evidence base in order to inform future research.

Methodology: This review utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and a rigorous scoping review method to search the literature. A comprehensive search of computerized databases was conducted in July 2018 in the following databases published from 2013 to 2018: CINAHL, PubMed, and Academic Search Complete.

Results: The database searches yielded a total of 183 articles. Forty-four duplicates were removed. There were 114 results excluded based on title and abstract ineligibility. Thirty-two relevant articles were retrieved for full-text examination. Eighteen of the articles were excluded based on the inclusion or exclusion criteria. References of 14 included articles were hand-searched for relevant works to ensure completeness of the search. Four pertinent additional articles were identified. The final analysis included 18 articles.

Discussion: Current research on technology use for frail older adults focuses on assessment and diagnosis. Methodological weaknesses limit generalizability and the validity of its findings. Few studies utilize frailty as an outcome measure, limiting available research directly related to frailty.

Conclusion: More research is needed on the potential for technological tools as interventions for frailty in older adults living at home, specifically, to prevent pre-frailty and frailty.

Keywords: frailty, frail elderly, aged, independent living, technology

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Technology Use and Frailty for Community Dwelling Older Adults: A Scoping Review

Frailty is a common geriatric syndrome, defined as a clinically recognizable state of increased vulnerability to adverse outcomes related to a decline in reserve across multiple systems, diminishing the ability to respond to acute, even minor, stressors such as surgery, loss of a spouse, minor infection, or change in medication regimen (Clegg et al., 2013). This decline in reserve places the individual at greater risk for poor health outcomes, including falls, disability, hospitalization, institutionalization, and mortality (Buckinx et al., 2015; Chang & Lin, 2015; Fried et al., 2001; Kane et al., 2012; Xue, 2011). Pre-frailty is a term used to describe a state of elevated risk for frailty where significant functional decline is not yet evident (Fried et al., 2001). This early stage represents a crucial intervention point when preventative measures would be most effective to implement. Frailty is a dynamic, reversible process with the potential for improvement, rather than an inevitable spiral of decline (Conroy & Elliot, 2016). Individuals transition between frailty states with potential for recovery from frail, pre-frail to robust status (Siriwardhana et al., 2018). This review focuses on community-dwelling older adults, defined as older adults living independently in the community, because this population is more commonly pre-frail, and will therefore potentially benefit most from early identification and intervention (Feng et al., 2017; Xue, 2011).

Background

Currently, there is no clear consensus regarding the definition of frailty, creating challenges in the identification and evaluation of frailty in older adults. However, it is commonly agreed that frailty is a clinically recognizable state of increased vulnerability to adverse outcomes related to a decline in physiologic reserve (Rockwood & Mitnitski, 2011; Siriwardhana et al., 2018). This is the definition of frailty that will be used for the purposes of this review.

The two most commonly used definitions of frailty are the Fried phenotype and the Frailty Index (FI) (Clegg et al., 2013; Kojima et al., 2018; Siriwardhana et al., 2018). The frailty phenotype defines frailty as a condition meeting three out of five phenotypic criteria including weight loss, exhaustion, low physical activity, slowness and weakness, reflecting underlying loss of physiologic reserve (Fried et al., 2001). The phenotype further identifies three stages of frailty, ranging from robust, pre-frail, and frail (Fried et al., 2001). The pre-frail stage is a transitional state, where one or two criteria are present and suggests a higher risk of progression to frailty (Fried et al., 2001). Critique of this definition is that it is limited to physiologic and functional domains and does not reflect the multi-dimensional nature of the frailty syndrome. With complex, multifactorial geriatric syndromes such as frailty, it is crucial to consider relevant domains outside of a discrete biological framework (Inouye et al., 2007).

The FI measures frailty by the number of accumulated deficits across multiple domains, including physical and cognitive impairment, comorbidities, disability, psychosocial risk factors, and geriatric syndromes such as falls, delirium, and incontinence (Rockwood & Mitnitski, 2011). The increased number of deficits are predictive of adverse health outcomes, including mortality (Kojima et al., 2018; Mitnitski et al., 2017). People, on average accumulate deficits as they age, however, the nature of the deficit and the rate at which they accumulate varies from person to person, reflecting the heterogeneity and complexity of the frailty phenomenon (Rockwood & Mitnitski, 2011). The use of the FI requires a comprehensive geriatric assessment (Rockwood & Mitnitski, 2011), thus limiting its practicality in everyday clinical practice due to potential time constraints.

In the absence of a gold standard defining frailty, prevalence rates vary widely from 4-59% across multiple frailty measures (Buckinx et al., 2015; Collard et al., 2012), presenting a potentially considerable population at risk. Trends suggest frailty increases with age, affects more women than men, is greater among African Americans than Caucasians, and is more prevalent among people with lower education, lower income, and higher rates of comorbidities (Buckinx et al., 2015; Collard et al., 2012; Feng et al., 2017; Xue, 2011). Additionally, nursing home residents are more likely to be frail than community-dwelling people; however, institutionalization could be a consequence of frailty itself (Buckinx et al., 2015). Frailty is a public health concern as it identifies individuals with a greater need for healthcare intervention and at high risk for dependency (Buckinx et al., 2015). Frailty is associated with disability in activities of daily living (ADLs), which are crucial for the maintenance of independent living (Kojima, 2017; Provencher et al., 2017). Since many older adults prefer to live at home, this represents a crucial intervention area to promote quality of life in this population.

Interventions to prevent and ameliorate frailty can improve older adults' lives, improve health, reduce adverse outcomes, and allow for maintenance of an independent lifestyle. A review of available literature reveals plentiful research on frailty interventions. Several systematic reviews and meta-analyses examined existing evidence for multiple frailty interventions (Apostolo et al., 2018; Chang & Lin, 2015; De Labra et al., 2015; De Vries et al., 2012; Puts et al., 2017; Silva et al., 2018; Theou et al., 2011). Studies indicated physical exercise effectively improved mobility and functional status in frail older adults (De Labra et al., 2015; De Vries et al., 2012). Nutritional interventions, such as protein supplementation, were also useful for targeting specific frailty markers, including nutritional deficiencies and weight loss (Apostolo et al., 2018). Multifactorial, multidisciplinary interventions were most effective in reducing frailty levels, specifically combined nutrition and exercise interventions (Apostolo et al., 2018; De Labra, 2015). Notably, there is little mention of technology as an intervention for frailty in the literature. Several recent studies explored the potential for technology as a tool for enhancing independence and quality of life, reducing healthcare costs by preventing and managing disability, along with frailty in the elderly (Pilotto et al., 2018). Domestic appliances that control and manage the physical environment can maintain and improve functional capacity in older adults living at home, such as sensor technology to detect fall risk and improve gait and mobility (Pilotto et al., 2018). Wearable technologies allow for remote evaluation and monitoring of frailty

and fall risk during daily activities, enabling early intervention (Armstrong et al., 2017). Most older adults prefer to live at home, and new and emerging technologies can help them do so safely and independently.

The Review

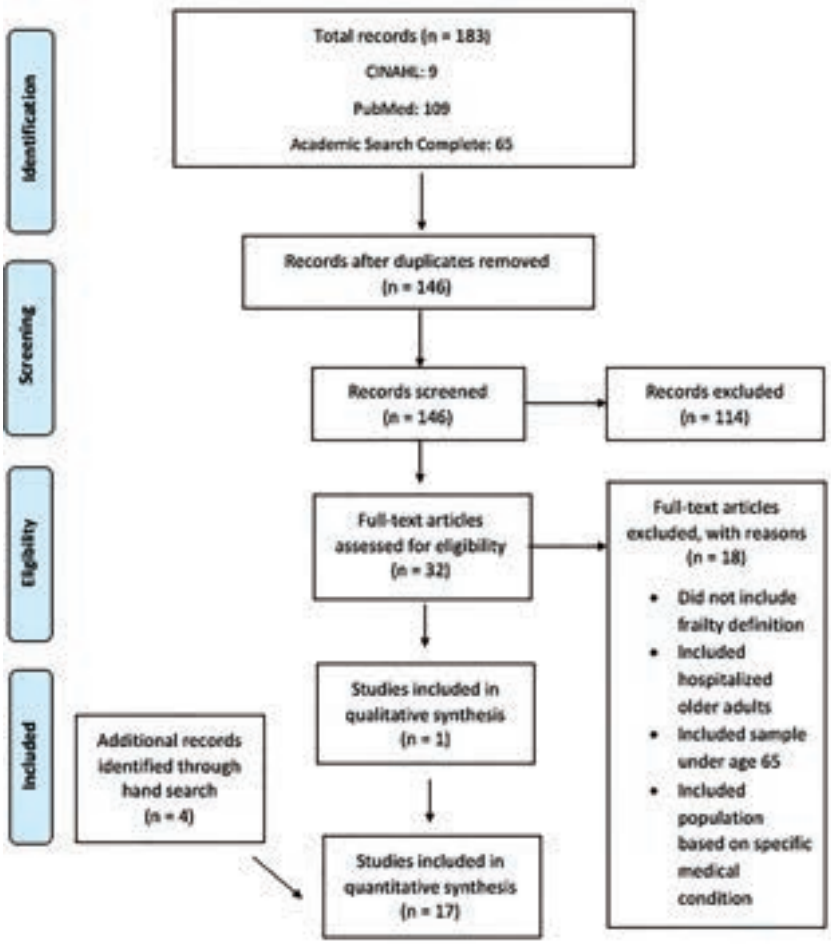
Aims

The purpose of this scoping review is to identify and summarize existing evidence relevant to technology use for frail, community-dwelling older adults in order to highlight areas of opportunity for future research. Specifically, this review focuses on technologies described in the literature for identification, assessment, prevention, and treatment for community-dwelling older adults with frailty, for use primarily by the older adults themselves. The expected increase in the elderly population will impact society in terms of increasing numbers of frail older adults with substantial need for support and interventions. Technological innovations may represent novel solutions to maintain functional abilities and independence for older adults living at home.

Design

This review used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Tricco et al., 2018) and a rigorous scoping review method to search the literature (Figure 1). The scoping review method was chosen because it is ideal for an emerging and critically under-researched area to identify trends and gaps in the literature to inform future researchers (Arksey & O'Malley, 2005). The research question that guided this review was, "What are the current practices, standard use, and recommendations for technology use for frail, community-dwelling older adults?" The following steps were used to conduct the search: 1) identify the research question, 2) identify relevant studies, 3) study selection, 4) organize the data, and 5) summarize the results.

Figure 1
PRISMA Search Strategy Flow Chart



Note. From "PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation," by Tricco, A.C., Lillie, E., Zarin, W., O'Brien, K.K., Colquhoun, H., Levac, D.,…Straus, S.E. 2018, *Annals of Internal medicine, 169*, 467-473. (https://doi:10.7326/M18-0850).

Search Methods

After several preliminary searches to identify keywords and gain familiarity with the literature, a comprehensive search of computerized databases was conducted in July 2018 in the following databases published from 2013 to 2018: CINAHL, PubMed, and Academic Search Complete. Related subject headings, MeSH terms, and keywords were identified in consultation with research librarians to capture a comprehensive list of potential sources. MeSH terms were identified and used to search the PubMed database. Keywords and subject headings were used for CINAHL and Academic Search Complete (Table 1). Finally, keywords were identified and combined to address all components of the research question: 1) elderly, 2) frailty, 3) community-dwelling, and 4) technology. The search strategy was designed to identify studies that used technology with a population of frail older adults aged 65 and over living in the community.

Table 1
Search Terms

Elderly	Frailty	Community Dwelling	Technology
Aged [Mesh] (SH) Aged, 80 and over [MeSH] frail elderly [MeSH] (SH) older adults (KW)	Frailty [MeSH] Frailty syndrome (SH) Frail (KW) prefrail (KW) prefrailty (KW)	community living (SH) community dwelling (KW) Independent Living [MeSH] Residence characteristics [MeSH]	Geriatrics/ instrumentation [MeSH]) Technology [Mesh] (SH) Assistive technology (SH) Telehealth (SH) Ehealth (KW) Mhealth (KW) Telemedicine [MeSH] (SH) Wearable electronic devices [MeSH] Remote monitoring (KW) Virtual reality [MeSH] Robotics [MeSH] Smartphone [MeSH]

Note. KW = Keyword; SH = Subject Heading; MeSH = Medical Subject Heading

Articles were included if they met the following criteria: 1) focused on adults aged 65 and over living in the community; 2) peer-reviewed; 3) published in the English language; 4) featured randomized controlled trials (RCTs), cohort studies, or qualitative research; and 5) include an operationalized definition of frailty. These criteria were chosen to meet this review's focus, namely technologies used for frail older adults living at home. The search was limited to the years 2013-2018 for practicality, to identify how technology was most recently used for the study population. Articles were excluded if they: 1) focused on adults younger than 65 or children; 2) included hospitalized older adults; 3) were published in a language other than English; 4) were study protocols, conference abstracts, unpublished dissertations or commentaries; 5) were measurement tool use or development studies; or 6) selected the target population based on the presence of a specific medical condition. As the search evolved, inclusion and exclusion criteria were revised to best address the research question (Table 2).

Table 2
Inclusion and Exclusion Criteria

Inclusion	Exclusion
Older adults over the age of 65 living in the community	Adults under 65 or children
Peer-reviewed	Hospitalized/institutionalized older adults
English language	Published in non-English language
RCT, cohort studies or qualitative research	Systematic review, study protocols, conference abstracts, unpublished dissertations or commentaries
Operationalized definition of frailty	Measurement tool use or development studies
	Selected the target population based on the presence of a specific medical condition

Search Outcomes

The database searches, as described above yielded a total of 183 articles. There were 41 duplicates, which were removed. One hundred fourteen of the results were excluded based on title and abstract. Thirty-two articles relevant to this review were retrieved for full-text examination. Eighteen of the articles were excluded based on inclusion or exclusion criteria. Fourteen of the articles met all inclusion criteria. References of those articles were then hand searched for relevant works to ensure the completeness of the search, after which four additional relevant articles were identified. The final analysis included 18 articles from several different countries including Ireland (n = 2), Japan (n =1), Spain (n = 4), the Netherlands (n = 3), and the United States (n = 8) (Table 3).

Results/Synthesis

The small number of studies included in this review indicates research on technology use for community-dwelling frail older adults with confirmed frailty status is limited. Analysis of included studies is organized by their objectives, namely frailty assessment, frailty intervention, and technology use. Studies are further grouped by assessment methods such as gait parameters, performance-based measures, and upper extremity frailty. An additional subheading was included to assess studies that

examined frailty proxy measures such as fall risk. The technology use category includes qualitative data on the use of technology in older adults.

Frailty Intervention

The impact of technology-supported, home-based exercise programs for frail older adults were evaluated (Dekker-van Weering et al., 2017; Garaedts et al., 2017). The studies were designed for the frail elderly living at home but did not measure frailty as an outcome. Instead, the studies used a frailty measure to identify frail individuals as part of inclusion criteria, however, frailty status was not measured as an outcome of the intervention. Studies used outcome measures such as gait performance, muscle strength, physical performance tests such as the Times Up and Go (TUG) test, which tangentially include aspects of frailty but fail to use a standardized frailty measure. Other outcome measures included adherence to an intervention such as an exercise program or user opinion regarding a proposed intervention. These research studies concluded that a combination of strength and balance training was most effective in addressing frailty in older adults (Dekker-van Weering et al., 2017; Geraedts et al., 2017; Ozaki et al., 2017). Internet connectivity was a common problem with home-based technologies and was noted as an important factor in study dropout rates (Geraedts et al., 2017). The long-term impact of technology-based exercise interventions was not evaluated.

Frailty Assessment

The most commonly used frailty definition in the included research was the Fried phenotype criteria (Galan-Mercant & Cuesta-Vargas, 2013; Galan-Mercant & Cuesta-Vargas, 2014; Galan-Mercant & Cuesta-Vargas, 2015; Greene et al., 2014a; Greene et al., 2014b; Martinez-Ramirez et al., 2015; Mohler et al., 2016; Muchna et al., 2018; Ozaki et al., 2017; Parvaneh et al., 2017; Rahemi et al., 2018; Razjouyan et al., 2018; Rye-Hanton et al., 2017; Toosizadeh et al., 2015). Twelve articles included in this review discussed technology-based assessment, diagnosis, and classification of frailty. Four of these studies examined different aspects of frailty in subsamples of the same cohort, namely, the Arizona Frailty Cohort (Mohler et al., 2016; Muchna et al., 2018; Schwenk et al., 2015; Toosizadeh et al., 2015). The instruments used for evaluation include body-worn sensors, sensors embedded in smartphones, and pendant sensors. The research studies evaluated various frailty-related parameters to complement or replace time and resource-intensive frailty assessment in the community setting. The use of these technologies for frailty identification was suggested as a tool for early identification of frailty during daily activities that may not be detectable on clinical exam in order to identify individuals who would benefit from early intervention.

Gait Parameters

Gait parameters were often used to identify frail individuals, as slowed gait and decreased muscle strength are known markers of frailty (Fried et al., 2001). Studies that evaluated pendant sensors, body sensors, as well as smartphone sensors identified specific gait parameters associated with frailty including, decreased step count, reduced gait speed, gait and stride irregularity, and decreased overall physical activity (Martinez-Ramirez et al., 2015; Rahemi et al., 2018; Razjouyan et al., 2018; Rye-Hanton et al., 2017; Schwenk et al., 2015). Various wearable and inertial sensors were used to identify individuals with frailty and distinguish between robust, pre-frail, and frail individuals. These sensors were suggested for use for remote frailty monitoring as the sensors can be worn at home and did not require skilled monitoring (Martinez-Ramirez et al., 2015; Rahemi et al., 2018; Razjouyan et al., 2018; Rye-Hanton et al., 2017; Schwenk et al., 2015).

Performance-Based Measures

Sensor-based measures of sit-to-stand and stand-to-sit transitions and the TUG test evaluated the use of wearable technology to complement or improve the accuracy of traditional frailty assessment methods (Galan-Mercant & Cuesta-Vargas, 2015; Greene et al., 2014a; Greene et al., 2014b) or to allow for non-expert assessment in unsupervised settings (Greene et al., 2014a; Greene et al., 2014b). Smartphone embedded sensors and chest-worn sensors were sensitive for frailty identification by capturing postural position changes during functional tasks that individuals often perform during the day, such as rising from a chair and turning around while walking (Galan-Mercant & Cuesta-Vargas, 2013; Parvaneh et al., 2017). Postural transitions and functional tasks were restricted in frail older adults as they compensated for frailty with increasingly careful movements (Galan-Mercant & Cuesta-Vargas, 2013; Parvaneh et al., 2017).

Various sensors were used to identify frail individuals during the performance of functional tasks during physical performance tests, including the TUG test and the sit-to-stand test (Galan-Mercant & Cuesta-Vargas, 2014; Galan-Mercant & Cuesta-Vargas, 2015; Greene et al., 2014a; Greene et al., 2014b). These studies identified individuals with frailty via body-worn sensor data alone (Galan-Mercant & Cuesta-Vargas, 2014; Galan-Mercant and Cuesta-Vargas, 2015). They also validated use of these sensors for frailty identification compared to established frailty measures such as the Fried phenotype (Greene et al., 2014a; Greene et al., 2014b). These measures were important for home-based use as they can be helpful in identifying frailty during non-monitored activities that individuals perform in their daily lives. Additionally, the technologies can be used by non-skilled users out of the clinical environment.

Upper Extremity Frailty

A study by Toosizadeh et al. (2015) presented an innovative method of identifying frailty categories using several upper extremity assessment parameters of elbow flexion. Results showed this upper extremity task discriminated between frailty groups; slowness discriminated between pre-frail and non-frail older adults, while weakness discriminated between pre-frail and frail older adults (Toosizadeh et al., 2015). This assessment method was proposed as advantageous over the standard Fried criteria assessment as a shorter and less strenuous task that still included several frailty markers (Toosizadeh et al., 2015). This method also did not include gait assessment, making it possible for use in individuals with gait problems or where inadequate space is available (Toosizadeh et al., 2015).

Frailty Proxy Measures

Wearable sensors were operationalized as devices that evaluated various gait performance measures as predictors of fall risk (Mohler et al., 2016; Muchna et al., 2018). While participants were screened for frailty, this information was utilized to describe the sample rather than the study outcome (Mohler et al., 2016; Muchna et al., 2018). Falls are a known adverse outcome of frailty and, along with gait abnormalities, are often used as a proxy measure for frailty in studies.

Level of Technology Use

Only one study by Peek et al. (2016) qualitatively explored the level of technology use by older adults living at home. Six major themes influenced the level of technology use in the context of aging in place: challenges in the domain of independent living, the influence of the social network, the influence of organizations, and the role of the physical environment (Peek et al., 2016). This highlighted the importance of technological solutions to consider older adults' personal, social, and physical context to optimize use.

Discussion

The aim of this scoping review was to identify and summarize existing evidence related to technology use for frail older adults living at home and to highlight research gaps in the evidence base. This review included studies that explored technologies used by older adults themselves, rather than peripheral technologies that individuals would not directly engage with, such as home monitoring systems. The purpose was to identify what technologies are currently being used for the frail older adult population and identify areas of opportunity for future research on other technologies that will maintain and increase the independence of frail older adults living at home.

Research on technology for frail older adults living at home is heavily dominated by methods for frailty assessment and identification. Only three studies in this review focused on technologies for use as an intervention for frailty in community-dwelling older adults (Dekker-van Weering, 2017; Garaedts, 2017; Ozaki et al., 2017). Furthermore, there is an added emphasis on using technologies to identify pre-frailty as a critical point for preventing and reversing frailty progression. Technologies can do this more efficiently and effectively than clinical evaluation as they can capture subtle changes in strength, functional performance, and gait. Wearable sensors and those embedded in smartphones offer tremendous potential to measure an individual's daily activity over prolonged periods in a non-invasive, inexpensive manner. Parameters that identify pre-frailty are particularly pivotal in this sense. Pre-frailty presents a decisive intervention point to prevent a spiral decline into frailty or to halt the progression of functional decline (Xue, 2011). Home-based sensors offer a possible solution for capturing subtle changes in individual behaviors that may not be evident during a routine clinical assessment and may signify muted indications of health status deterioration.

Following frailty identification, intervention is essential to prevent functional decline. However, there is a dearth of available evidence on the application of technology as an intervention for frailty in community-dwelling older adults, especially interventions measuring frailty as an outcome. Technology administered or facilitated exercise programs may enable broader access to this intervention for older adults who have difficulty leaving home due to mobility or transportation issues. Various technologies can also provide remote, automated coaching to reduce the need for skilled, real-time assistance. Social interventions can also be deployed remotely, giving access to online group activities when an in-person meeting is not possible. This highlights an area of opportunity for future research to develop and apply innovative technologies as an intervention for frailty. Additionally, many studies evaluating technology for community-dwelling frail older adults took place in a laboratory setting, not in a real home setting, where actual implementation and conditions are unclear. Additional research is needed to imagine the future implementation of these technologies for individuals in their homes. Moreover, older adults' input should be considered when developing interventions to improve acceptability and usability.

Areas for future research include studies with larger sample sizes, and samples that include older adults with cognitive impairment. Many studies with frail older adults included small sample sizes. Larger studies are needed to improve the generalizability and validity of research outcomes. Additionally, older adults with cognitive impairment are notably missing from study samples evaluating the use of technology in cohorts of frail elderly. Cognitive frailty, or the simultaneous presence of physical frailty and cognitive impairment in older adults without a diagnosis of dementia, is an important aspect of frailty (Robertson et al., 2013) and bears further evaluation in future studies. Frailty and cognitive impairment are related, but distinct concepts that frequently co-exist (Robertson et al., 2013). The inclusion of individuals with cognitive impairment in future frailty studies is certainly warranted.

The findings of this review are especially important in light of the COVID-19 pandemic, where the toll of necessary public health measures to contain the pandemic, such as physical distancing and isolation on older adults, is yet unknown and potentially catastrophic in terms of functional deterioration, increased loneliness, and mental health challenges. These challenges highlight the necessity of technological solutions to address the needs of frail older adults living at home. This review highlights the various technologies already explored for use in the home and sheds light on how these technologies can be used in the future to meet the essential needs of frail older adults in the community. This includes remote monitoring for frailty assessment and technologically administered interventions (e.g., exercise interventions) to maintain physical function while isolating in the home and social and cognitive interventions to address the holistic needs of this population.

Limitations

Inclusion criteria in terms of types of studies included in this review were narrow, and content available in abstracts, editorials, and dissertations may have broadened the findings. Additionally, limiting inclusion to English language articles potentially eliminated relevant articles written in other languages. The narrow inclusion criteria were purposeful in the sense that this review sought to identify a very particular population at risk, namely

adults over the age of 65 living at home, and how technology was used in this population. However, this does eliminate a larger risk pool of individuals that may warrant further study in a different context. This review also sought to identify technology used in this population, particularly those that older adults interact with directly as an intervention for frailty. Articles that discussed technologies not used by the older adult, such as those used by caregivers or healthcare providers in the service of frail older adults, were excluded. These technologies were therefore not captured in this review but may be useful for future research.

Importantly, although all studies in this review include a sample of frail older adults, none measured frailty as an outcome. Instead, studies used various gait parameters and performance measures as the study outcomes. Additionally, while there is no uniform measure for frailty employed by all studies included in this review, the Fried phenotype is used more than any other frailty definition. Some studies use frailty proxy measures such as physical disability, ADL disability, falls, or gait parameters in place of discrete frailty assessment. The variable definitions and frailty measures employed in the literature make it difficult to cumulatively and quantitatively analyze the evidence base in this area.

Conclusion

Various effective interventions for frailty are well established in the literature. The use of technology for frail older adults is heavily concentrated on the assessment and diagnosis of frailty. More research is needed on the potential for technological tools as interventions for frailty in community-dwelling elderly, specifically for detecting and preventing pre-frailty and frailty. Future studies should include adequate sample sizes to improve the validity and generalizability of results, a focus on frail older adults with cognitive impairment, and an examination of interventions using frailty as a variable to refine the applicability and practical application of the results to the frail elderly population.

Table 3
Summary of Included Literature

Authors, Year, Country	Design	Purpose	Sample	Results
Dekker-van Weering et al. (2017), The Netherlands	Randomized controlled trial	To investigate the use and user experience of an online home-based exercise program and to determine whether the intervention improved quality of life and health status of pre-frail older adults compared to a control group.	37 pre-frail community dwelling older adults Age 65-75 16 experimental 21 control	A home-based exercise program is easy to use and has potential in improving quality of life and health status in pre-frail older adults living at home.
Galan-Mercant and Cuesta-Vargas (2013), Spain	Cross-sectional study	To describe the variability of the accelerations, angular velocity and displacement of the trunk during the sit to stand and stand to sit transitions in two groups of frail and physically active elderly persons through instrumentation with the smartphone.	30 older adults Age >65 14 frail 16 non-frail	The inertial sensor fitted in the iPhone 4 can analyze kinematics of the Si-St and St-Si transitions in frail and robust older adults to discriminate between the two groups.
Galan-Mercant and Cuesta-Vargas (2014), Spain	Cross-sectional study	To measure and describe the variability of acceleration, angular velocity and trunk displacement in the 10m TUG test through instrumentation with the iPhone 4.	30 older adults Age >65 14 frail 16 non-frail	The inertial sensor in the iPhone 4 is capable of studying and analyzing the kinematics of the TUG test in frail and non-frail elderly; allows for more sensitive differentiation between the two groups than the traditionally used variable of time.

Galan-Mercant and Cuesta-Vargas (2015), Spain	Cross-sectional study	To determine the series of kinematic variables with the greatest precision in discriminating between frail and non-frail elderly in the 10m TUG test using inertial sensors embedded in the iPhone 4 compared to the traditional time variable.	30 older adults Age >65 14 frail 16 non-frail	Kinematic variables obtained from inertial sensors embedded in smartphone technology during the TUG test can discriminate between frailty status.
Geraedts et al. (2017), The Netherlands	Prospective cohort study	To evaluate the feasibility and user opinion of a home-based exercise program supported by a sensor and tablet application	40 frail, community dwelling older adults Age >70 Ability to walk 10m independently or with walking aid	A home-based exercise program using novel technology is feasible. Regular coaching has a positive influence on adherence.
Greene, Doheny, Kenny and Caufield (2014), Ireland	Observational, cross-sectional study	To investigate the combination of assessments of frailty and falls risk in older adults.	130 community dwelling older adults Age >65 Ability to walk without assistance	Sensor data obtained from 3 physical assessments resulted in improved classification of falls risk and frailty.
Greene, Doheny, O'Halloran and Kenny (2014), Ireland	Observational, cross-sectional study	To investigate a fast method for automatic, quantitative assessment of the frailty state based on a simple protocol employing body worn inertial sensors	399 community dwelling older adults Age >60 30 frail 185 pre-frail 184 non-frail 115 male 284 female	Assessment with well-known TUG mobility test and inertial sensors can be a fast, effective way of non-expert assessment of frailty
Martinez-Ramirez et al. (2015), Spain	Observational, cross-sectional study	To investigate whether a collection of parameters extracted from the trunk acceleration signals could provide additional accurate information about frailty syndrome.	718 older adults 319 males 399 females Age 75.4 +/-6.1 Ability to complete 3m walk test at their own gait velocity	Gait parameters simultaneously used with gait velocity can be used to more accurately classify frailty status; may allow for early detection of pre-frailty.
Mohler et al. (2016), USA	Observational descriptive study	To evaluate wearable sensor-based measures of gait, balance, and physical activity that are predictive of future falls in community-dwelling older adults.	119 community dwelling older adults Age >65	The association between motor performance and risk of falling is dependent on frailty status. Wearable sensor is a tool for assessing fall risk in the home setting.
Muchna et al. (2018), USA	Observational descriptive study	To examine the effect of foot problems on the likelihood of falls, frailty syndrome, motor performance and physical activity in community dwelling older adults.	117 community dwelling older adults 41 non-frail 56 pre-frail 20 frail Age >65	Foot problems are associated with frailty. Sensor-based gait parameters can identify foot problems and older adults at risk for falls or gait abnormalities related to foot problems.

Ozaki et al. (2017), Japan	Cross-over trial	To examine the efficacy of postural strategy training using a balance exercise assist robot as compared with conventional balance training for frail older adults	27 community dwelling frail or prefrail older adults 7 men, 20 women Age >65	In frail or prefrail older adults, robotic exercise was more effective for improving dynamic balance and lower extremity muscle strength than conventional exercise.
Parvaneh et al. (2017), USA	Observational cohort study	To monitor and assess daily postural transition differences by frailty level in community dwelling older adults.	120 community dwelling older adults Age >65 Without gait or mobility disorders	Monitoring daily physical activity, specifically quantification of postural transitions using inertial wearable sensors may provide an objective tool for assessing frailty during unsupervised conditions in home.
Peek et al. (2016), The Netherlands	Qualitative explorative field study	To explore which factors influence the level of use of various types of technology by older adults who are aging in place and to describe these factors in a comprehensive model	53 community dwelling older adults Aged 68-95	Older adults perceptions and use of technology are embedded in their personal, social and physical context.
Rahemi et al. (2018), USA	Observational cohort study	To investigate the feasibility of developing a foot-worn sensor to assess frailty	161 community dwelling older adults Age >55 Non-frail 49 Pre-frail 92 Frail 20	Foot-worn sensor-derived gait measures during propulsive phase of walking can be sensitive metrics in frailty assessment.
Razjouyan et al. (2018), USA	Cross-sectional study	To determine which sensor-derived parameters are capable of discriminating between the 3 frailty categories.	153 community dwelling older adults Age >60 Able to walk 15 feet independently with or without aid	A pendant sensor can identify pre-frailty via daily home monitoring.
Rye Hanton et al. (2017), USA	Observational cohort study	To demonstrate data derived from ubiquitous mobile phone technology can be employed to continuously measure aspects of participant health status, including step counts, gait speed and activity level.	43 ambulatory, community dwelling older adults 25 robust 18 frail	Continuous mobile phone-based measures of activity and mobility can differentiate between frailty and non-frail older adults.
Schwenk et al. (2015), USA	Observational, cross-sectional study	To examine the ability of wearable sensor-based in-home assessment of gait, balance, and physical activity to discriminate between frailty levels.	125 older adults 44 non-frail 60 pre-frail 21 frail	Unique parameters derived from objective assessment of gait, balance, and physical activity are sensitive for the identification of pre-frailty and classification of a subjects' frailty level.

Toosizadeh et al. (2015), USA	Cross sectional study	To objectively identify frailty using wireless sensors and an upper extremity motion assessment that does not rely on gait.	117 community dwelling older adults 50 nonfrail 51 prefrail 16 frail Age >65	This upper extremity frailty assessment method integrates low cost sensors and implemented in less than 1 minute objectively identifies frailty.

References

Apostolo, J., Cooke, R., Bobrowicz-Campos, E., Santana, S., Marcucci, M., Cano, A., Vollenbroek-Hutten, M., Germini, F., D'Avanzo, B., Gwyther, H., & Holland, C. (2018). Effectiveness of interventions to prevent pre-frailty and frailty progression in older adults: A systematic review. *JBI Database of Systematic Reviews and Implementation Reports, 16*(1). http://dx.doi.org/10.11124/JBISRIR-2017-003382

Buckinx, F., Rolland, Y., Reginster, J., Ricour, C., Petermans, J., & Bruyere, O. (2015). Burden of frailty in the elderly population: Perspectives for a public health challenge. *Archives of Public Health, 73*(1). http://dx.doi.org/10.1186/s13690-015-0068-x

Chang, S. & Lin, P. (2015). Frail phenotype and mortality prediction: A systematic review and meta-analysis of prospective cohort studies. *International Journal of Nursing Studies, 52*, 1362-1374. http://dx.doi.org/10.1016/j.ijnurstu.2015.04.005

Clegg, A., Young, J., Iliffe, S., Rikkert, M.O., & Rockwood, K. (2013). Frailty in elderly people. *Lancet, 381*(9868), 752-762. http://dx.doi.org/10.1016/S0140-6736(12)62167-9

Collard, R.M., Boter, H., Schoevers, R., & Voshaar, R.C. (2012). Prevalence of frailty in community dwelling older persons: A systematic review. *JAGS, 60*, 1487-1492. http://dx.doi.org/10.1111/j.1532-5415.2012.04054.x

Conroy, S. & Elliot, A. (2016). The frailty syndrome. *Medicine, 45*(1), 15-18. http://dx.doi.org/10.1016/j.mpmed.2016.10.010

Dekker-van Weering, M., Jansen-Kosterink, S., Frazer, S., & Vollenbroek-Hutten, M. (2017). User experience, actual use, and effectiveness of an information and communication technology-supported home exercise program for pre-frail older adults. *Frontiers in Medicine, 4*(208). http://dx.doi.org/10.3389/fmed.2017.00208

De Labra, C., Guimaraes-Pinheiro, C., Maseda, A., Lorenzo, T., & Millan-Calenti, J.C. (2015). Effects of physical exercise interventions in frail older adults: A systematic review of randomized controlled trials. *BMC Geriatrics, 15*(154). http://dx.doi.org/10.1186/s12877-015-0155-4

De Vries, N.M., van Ravensberg, C.D., Hobbelen, J.S.M., Olde Rikkert, M.G.M., Staal, J.B., & Nijhuis-van der Sanden, M.W.G. (2012). Effects of physical exercise therapy on mobility, physical functioning, physical activity and quality of life in community-dwelling older adults with impaired mobility, physical disability, and/or multi-morbidity: A meta-analysis. *Aging Research Reviews, 11*, 136-149. http://dx.doi.org/10.1016/j.arr.2011.11.002

Feng, Z., Lugtenberg, M., Franse, C., Fang, X., Hu, S., Jin, C., & Raat, H. (2017). Risk factors and protective factors associated with incident or increase of frailty among community-dwelling older adults: A systematic review of longitudinal studies. *PLoS One, 12*(6). http://dx.doi.org/10.1371/journal.pone.0178383

Fried, L.P., Tangen, C.M., Walston, J., Newman, A.B., Hirsch, C., Gottdiener, J., Seeman, T., Russell, T., Kop, W.J., Burke, G., & McBurnie, M.A. (2001). Frailty in older adults: Evidence for a phenotype. *Journal of Gerontology, 56A*(3), M146-M156. http://dx.doi.org/10.1093/gerona/56.3.m146

Galan-Mercant, A. & Cuesta-Vargas, A.I. (2013). Differences in trunk accelerometry between frail and nonfrail elderly persons in sit-to-stand and stand-to-sit transitions based on a mobile inertial sensor. *JMIR Mhealth Uhealth, 1*(2), e21. http://dx.doi.org/10.2196/mhealth.2710

Galan-Mercant, A. & Cuesta-Vargas, A.I. (2014). Differences in trunk accelerometry between frail and non-frail elderly persons in functional tasks. *BMC Research Notes, 7*(100). http://dx.doi.org/10.1186/1756-0500-7-100

Galan-Mercant, A. & Cuesta-Vargas, A.I. (2015). Clinical frailty syndrome assessment using inertial sensors embedded in smartphones. *Physiologic Measurement, 36*, 1929-1942. http://dx.doi.org/10.1088/0967-3334369/1929

Geraedts, H.A.E., Zijlstra, W., Zhang, W., Spoorenberg, S.L.W., Baez, M., Khaghani, I., Baldus, H., & Stevens, M. (2017). A home-based exercise program driven by tablet application and mobility monitoring for frail older adults: Feasibility and practical implications. *Preventing Chronic Disease, 14*(12). http://dx.doi.org/10.5888/pcd14.160227

Greene, B.R., Doheny, E.P., Kenny, R.A., & Caulfield, B. (2014a). Classification of frailty and falls history using a combination of sensor-based mobility assessments. *Physiological Measurement, 35*, 2053-2066. http://dx.doi.org/10.1088/0967-3334/35/10/2053

Greene, B.R., Doheny, E.P., O'Halloran, A., & Kenny, R.A. (2014b). Frailty status can be accurately assessed using inertial sensors and the TUG test. *Age and Ageing, 43*, 406-411. http://dx.doi.org/10.1093/ageing/aft176

Inouye, S.K., Studenski, S., Tinetti, M.E., & Kuchel, G.A. (2007). Geriatric syndromes: Clinical, research and policy implications of a core geriatric concept. *JAGS, 55*(5), 780-791. http://dx.doi.org/10.1111/j.1532-5415.2007.01156.x

Kane, R.L., Shamliyan, T., Talley, K., & Pacala, J. (2012). The association between geriatric syndromes and survival. *JAGS, 60*(3), 896-904. http://dx.doi.org/10.1111/j.1532-5415.2012.03942.x

Kojima, G. (2017). Frailty as a predictor of disabilities among community-dwelling older people: A systematic review and meta-analysis. *Disability and Rehabilitation, 39*(19). http://dx.doi.org/10.1080/09638288.2016.1212282

Kojima, G. (2018). Frailty defined by FRAIL scale as a predictor of mortality: A systematic review and meta-analysis. *JAMDA, 19*, 480-483. http://dx.doi.org/10.1016/j.jamda.2018.04.006

Martinez-Ramirez, A., Martinikorena, I., Gomez, M., Lecumberri, P., Millor, N., Rodriguez-Manas, L., Garcia, F.J., & Izquierdo, M. (2015). Frailty assessment based on trunk kinematic parameters during walking. *Journal of Neuroengineering and Rehabilitation*. http://dx.doi.org/10.1186/s12984-015-0040-6

Mohler, J.M., Wendel, C.S., Taylor-Piliae, R.E., Toosizadeh, N., & Najafi, B. (2016). Motor performance and physical activity as predictors of prospective falls in community-dwelling older adults by frailty level: Application of wearable technology. *Gerontology, 62*, 654-664. http://dx.doi.org/10.1159/000445889

Muchna, A., Najafi, B., Wendel, C.S., Schwenk, M., Armstrong, D.G., & Mohler, J. (2018). Foot problems in older adults. *Journal of the American Podiatric Medical Association, 108*(2). http://dx.doi.org/10.7547/15-186

Ozaki, K., Kondo, I., Hirano, S., Kagaya, H., Saitoh, E., Osawa, A., & Fujinori, Y. (2017). Training with a balance exercise assist robot is more effective than conventional training for frail older adults. *Geriatrics and Gerontology International, 17*, 1982-1990. http://dx.doi.org/10.1111/ggi.13009

Parvaneh, S., Mohler, J., Toosizadeh, N., Grewal, G.S., & Najafi, B. (2017). Postural transitions during activities of daily living could identify frailty status: Application of wearable technology to identify frailty during unsupervised condition. *Gerontology, 63*, 479-487. http://dx.doi.org/10.1159/000460292

Peek, S.T., Luijkx, K.G., Rijnaard, M.D., Nieboer, M.E., van der Voort, C.S., Aarts, S., van Hoof, J., Vrijhoef, H.J.M., & Wouters, E.J.M. (2016). Older adults' reasons for using technology while aging in place. *Gerontology, 62*, 226-237. http://dx.doi.org/10.1159/000430949

Pilotto, A., Boi, R., & Petermans, J. (2018). Technology in geriatrics. *Age and Ageing, 0*, 1-4. http://dx.doi.org/10.1093/ageing/afy026

Provencher, V., Beland, F., Demers, L., Desrosiers, J., Bier, N., Avila-Funes, J.A., Galand, C., Julien, D., Fletcher, J.D., Trottier, L., & Hami, B. (2017). Are frailty components associated with disability in specific activities of daily living in community-dwelling older adults? A multicenter Canadian study. *Archives of Gerontology and Geriatrics, 73*, 187-194. http://dx.doi.org/10.1016/j.archger.2017.07.027

Puts, M.T.E., Toubasi, S., Andrew, M.K., Ashe, M.C., Ploeg, J., Atkinson, E., Ayala, A.P., Roy, A., Monforte, M.R., Bergman, H., & McGilton, K. (2017). Interventions to prevent or reduce the level of frailty in community-dwelling older adults: a scoping review of the literature and international policies. *Age and Ageing, 46,* 383-392. http://dx.doi.org/10.1093/ageing/afw247

Rahemi, H., Nguyen, H., Lee, H., & Najafi, B. (2018). Toward smart footwear to track frailty phenotypes using propulsion performance to determine frailty. *Sensors, 18*(1763). http://dx.doi.org/10.3390/s18061763

Razjouyan, J., Naik, A.D., Horstman, M.J., Kunik, M.E., Amirmazaheri, M., Zhou, H., Sharafkhaneh, A., & Najafi, B. (2018). Wearable sensors and the assessment of frailty among vulnerable older adults: An observational cohort study. *Sensors, 18*(1336). http://dx.doi.org/10.3390/s18051336

Robertson, D.A., Savva, G.M., & Kenny, R.A. (2013). Frailty and cognitive impairment – a review of the evidence and causal mechanisms. *Ageing Research Reviews, 12,* 840-851. http://dx.doi.org/10.1016/j.arr.2013.06.004

Rockwood, K. & Mitnitski, A. (2011). Frailty defined by deficit accumulation and geriatric medicine defined by frailty. *Clinical Geriatric Medicine, 27*, 17-26. http://dx.doi.org/10.1016/j.cger.2010.08.008

Rye-Hanton, C., Kwon, Y., Aung, T., Whittington, J., High, R.R., Goulding, E.H., Schenk, A.K., & Bonasera, S.J. (2017). Mobile phone-based measures of activity, step count, and gait speed: Results from a study of ambulatory adults in a naturalistic setting. *JMIR Mhealth Uhealth, 5*(10), e104. http://dx.doi.org/10.2196/mhealth.5090

Schwenk, M., Mohler, J., Wendel, C., D'Huyvetter, K., Fain, M., Taylor-Piliae, R., & Najafi, B. (2015). Wearable sensor-based in-home assessment of gait, balance and physical activity for discrimination of frailty status: Baseline results of the Arizona Frailty Cohort Study. *Gerontology, 61*, 258-267. http://dx.doi.org/10.1159/000369095

Silva, R., Pizato, N., Da Mata, F., Figueiredo, A., Ito, M., & Pereira, M.G. (2018). Mediterranean diet and musculoskeletal functional outcomes in community-dwelling older people: A systematic review and meta-analysis. *Journal of Nutrition Health and Aging, 22*(6), 655-663. http://dx.doi.org/10.1017/s12603-017-0993-1

Siriwardhana, D.D., Hardoon, S., Rait, G., Weerasinghe, M.C., & Walters, K.R. (2018). Prevalence of frailty and prefrailty among community-dwelling older adults in low-income and middle-income countries: A systematic review and meta-analysis. *BMJ Open, 8*, e018195. http://dx.doi.org/10.1136/bmjopen-2017-018195

Theou, O., Stathokostas, L., Roland, K.P., Jakobi, J.M., Patterson, C., Vandervoort, A.A., & Jones, G.R. (2011). The effectiveness of exercise interventions for the management of frailty: A systematic review. *Journal of Aging Research*. http://dx.doi.org/10.4061/2011/569194

Toosizadeh, N., Mohler, J., & Najafi, B. (2015). Assessing upper extremity motion: An innovative method to identify frailty. *JAGS, 63*, 1181-1186. http://dx.doi.org/10.1111/jgs.13451

Tricco, A.C., Lillie, E., Zarin, W., O'Brien, K.K., Colquhoun, H., Levac, D., Moher, D., Peters, M.D.J., Horsley, T., Weeks, L., Hempel, S., Akl, E.A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M.G., Garritty, C., … Straus, S.E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal medicine, 169*, 467-473. http://dx.doi.org/10.7326/M18-0850

Xue, Q. (2011). The frailty syndrome: Definition and natural history. *Clinical Geriatric Medicine 27*, 1-15. http://dx.doi.org/10.1016/j.cger.2010.08.009

ORIGINAL RESEARCH

Health Policy Immersion Experience of Doctoral Nursing Students: A Phenomenological Study

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Abstract

Background: In today's political environment, there is a significant need for healthcare professionals to be aware of health policy and its impact on practice and the population. Nursing, a respected and trusted profession, has a responsibility to increase its awareness and advocacy efforts to ensure practice and execution of responsible and ethical health policy.

Objectives: The purpose of this study was to describe the lived experience of doctoral nursing students' (PhD and DNP) engagement in a week-long immersion trip to Washington, D.C. as a requirement of their mandatory health policy course. This immersion trip encompassed participation in numerous activities that focused on health policy, nursing's role in research, and its presence in the political arena. In addition to describing doctoral nursing students' lived experience, the researchers sought to discover how this experience impacts doctorally-prepared nurses' political awareness and future interest in health policy.

Methods: Data were gathered using Google Forms to obtain doctoral nursing students' experiences after participating in a week-long Washington, D.C. immersion as part of their mandatory doctoral coursework at a Mid-Atlantic college in the United States. The survey was emailed to 43 PhD and DNP students, of which 30 met the inclusion criteria. Demographic data analysis, in addition to thematic analysis of survey responses with the aid of NVivo, were performed.

Results: Four themes emerged from the analysis to describe the experience and impact that the week-long Washington, D.C. immersion had on doctoral nursing students: Knowledge and Understanding of the Political Process, Recognition of the Role Professional Nursing Organizations Play in the Political Arena, Empowerment Through Increased Awareness, and Nursing's Role as an Advocate for the People

Conclusion: Through increased knowledge and awareness of health policy, doctorally-prepared nurses may be more inclined to seek and engage in the political arena and actively participate in advocacy efforts to improve health policy and the healthcare system.

Keywords: advocacy, doctoral nursing students, health policy, healthcare system, political process

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Health Policy Immersion Experience of Doctoral Nursing Students: A Phenomenological Study

In light of today's political environment, there is a significant need for healthcare professionals to be aware of current health policy and its impact on practice and the population. Nursing, a respected and trusted profession, has a responsibility to increase its awareness and advocacy efforts to ensure the practice and execution of responsible and ethical health policy. Nurses, as the largest group of healthcare professionals, have the ability to identify and bring to light the healthcare needs of the people (Hinshaw & Grady, 2011).

Nursing research, with its emphasis on health promotion, health disparities, management of chronic illnesses, and caregiving, can serve as a crucial guide for government officials as they set political agendas and introduce legislation for the betterment of society (Hinshaw & Grady, 2011). Through lobbying efforts of professional nursing organizations, such as the American Nurses Association (ANA), government officials can gain awareness and insight into current health issues, which directly impact the public. While professional nursing organizations engage in health policy, all nurses need to be aware of and involved in this process.

Background

Health policy, as per the World Health Organization (2018), "refers to decisions, plans and actions which are undertaken to attain specific healthcare goals within a society" (para. 1). It provides the foundation and domain for which both healthcare and public health systems operate. Appointed or elected local, state, and national officials actualize the ideas, decisions, plans, and actions surrounding health policy. There are numerous complex processes involved in the development, implementation, and evaluation of health policy. Healthcare professionals have a shared interest in knowing about and engaging in the intricate political and regulatory processes of health policy. In turn, these policies impact healthcare professionals' practice and the populations they serve exponentially.

In 2003, the Institute of Medicine (IOM) expressed the importance of training healthcare professionals in health policy. They stated that education in policy analysis, development, and application need to be addressed, as "dwelling on the science of public health without paying appropriate attention to both politics and policy will not be enough" (p. 13). Offering education in health policy to students of the healthcare professions is a means to enhance their understanding and increase their political engagement (DiCenso et al., 2012; Jansson et al., 2015; Primomo & Björling, 2013).

While clinical care is extremely valuable, research demonstrates that healthcare rendered by clinicians has less impact on the health of the population than the social determinants of health (IOM, 2011; Russo, 2015). Healthcare professionals are accustomed to advocating for their patients in a clinical, one-on-one level, typically at the bedside or in a healthcare facility. However, healthcare professionals achieve greater outcomes when they advocate at the policy level. Good health is not solely the result of competent, one-on-one care provided by healthcare clinicians, but also the result of creating conditions in which people can be healthy. Sound health policies, laws and regulations positively influence the health of millions of people (IOM, 2011).

Although the IOM made its recommendation relating to health policy education, it remains that current training for nurses and healthcare professionals is limited and does not include the depth of policy education required for transformational changes in population health (DiCenso et al., 2012; Heiman et al., 2015). Barriers to the implementation of health policy education include numerous challenges of integrating health policy into clinical training programs, such as nursing and medicine. Notably, there is a lack of perceived relevance to the program, lack of faculty interest and knowledge, including lack of faculty recruitment with policy expertise. In addition, a lack of resources, as well as conflicts with scheduling or time constraints, specifically those that would compete with core required clinical training, serve as barriers (Cohen & Milone-Nuzzo, 2001, DiCenso et al., 2012; Heiman et al., 2016; Mou et al., 2011).

Healthy People 2020 identifies that eliminating disparities and achieving health equity will require addressing, not only disparities related to healthcare, but also those of structural and environmental factors, including social determinants of health (United States Department of Health & Human Service, 2010). Health policy education for students of the health professions inspires future clinicians to address issues that ail populations' social determinants of health, as well as treat patients' maladies.

This phenomenological study aimed to describe the lived experience of doctoral nursing students' engagement in a week-long immersion trip to Washington, D.C. as a requirement of their health policy course. In addition to describing doctoral nursing students' lived experience, the researchers sought to discover how this experience impacts doctorally-prepared nurses' political awareness. This engagement in health policy can positively influence population health in the future.

Methods

Design

A phenomenological approach was chosen to explore the lived experiences of doctoral nursing students' week-long Washington, D.C. immersion and its impact on future practice. Interpretive phenomenology, as outlined by van Manen (1997), employs both interpretive and descriptive elements and ''aims at gaining a deeper understanding of the nature of the meaning of our everyday lived experiences'' (p. 9). Exploring the participants' lived experience offers a deeper and richer meaning to provide a better understanding of its impact on the participants.

Data Collection and Survey

Data collection occurred from October 2018 through January 2019, using Google Forms sent via email to doctoral nursing students (PhD and DNP) to explore their lived experiences after their mandatory participation in a week-long Washington, D.C. immersion encounter, as a requirement to satisfy the health policy course embedded in both the PhD and DNP programs. Demographic data analysis, in addition to thematic analysis of survey responses with the aid of NVivo 12 were performed.

Survey questions used to obtain participants' demographics included age of participant, the current program in which enrolled – PhD or DNP, as well as the current year in their program. Participants were provided unlimited text capability to type in their own words to describe their experience. The focused question asked of each participant was, *What effect, if any, did the Washington Immersion Experience have on you as a nursing professional?*

Ethics

The researchers obtained an Institutional Review Board (IRB) approval from the institution where the study took place, a college located in the Mid-Atlantic region of the United States. Participants volunteered and provided informed consent prior to the survey. Responses were anonymous and there were no identifiers retained or recorded at any time from the participants.

Sample and Setting

Following IRB approval, 43 potential participants, picked using purposive sampling, received an electronic correspondence, which provided a description of the study, a request for their voluntary participation, and the link to the Google Forms page. Of those 43 emailed, 30 met the inclusion criteria. The criteria included current enrollment in a doctoral nursing program (PhD or DNP) at the Mid-Atlantic US college with successful completion of the mandatory health policy course, including the fulfillment of the week-long Washington, D.C. immersion experience.

Fifty percent of the prospective 30 students returned the completed data collection tool. The demographic data of these 15 participants who met the inclusion criteria for this research appear on Table 1. This sample size was accordant with other phenomenological studies and allowed for proper identification of themes and patterns (Guest et al., 2006). Data saturation occurred after 11.

Table 1

Frequency Distribution of Demographic Data of Study Participants

Description	N
Program Type	
PhD	12
DNP	3
Age	
< 30	0
30-39	4
40-49	4
50-59	5
≥60	2
Program Year	
2nd	3
3rd	4
4th	3
5th	5
Total Participants	15

The participants ranged in age from 30 to greater than 60 years old with data showing four in the 30-39 age range, four in the 40-49 age range, five in the 50-59 age range, and two as ≥60 years of age (Figure 1). Of the 15 participants, 12 were current PhD students and three were current DNP students (Figure 2) with three participants in their second year, four in their third year, three in their fourth year and five in their fifth year of studies (Figure 3).

Figure 1

Participants' Age Distribution by Percentage

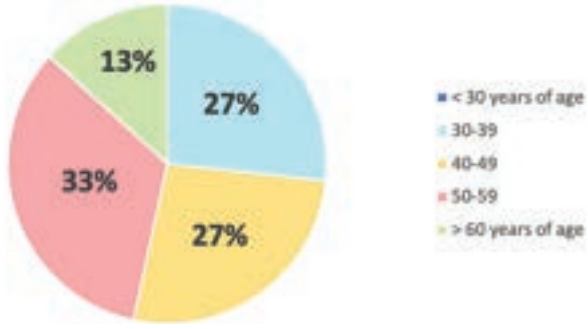


Figure 2

Doctoral Program Type, Distribution by Percentage

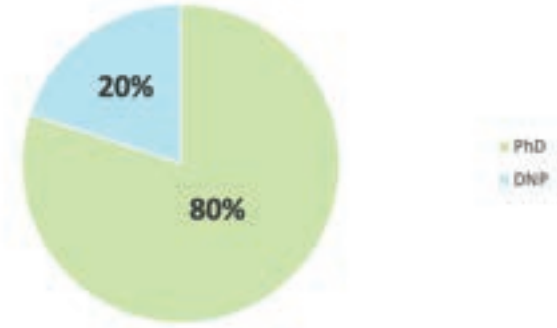
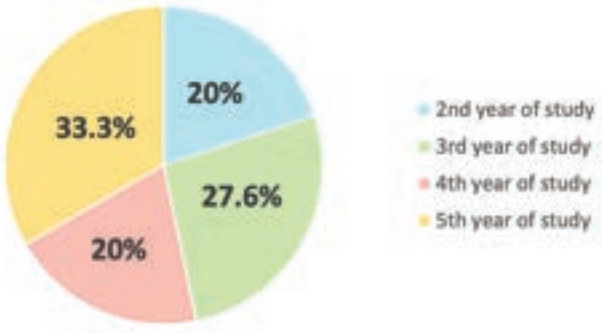


Figure 3

Current Program Year of Participants by Percentage



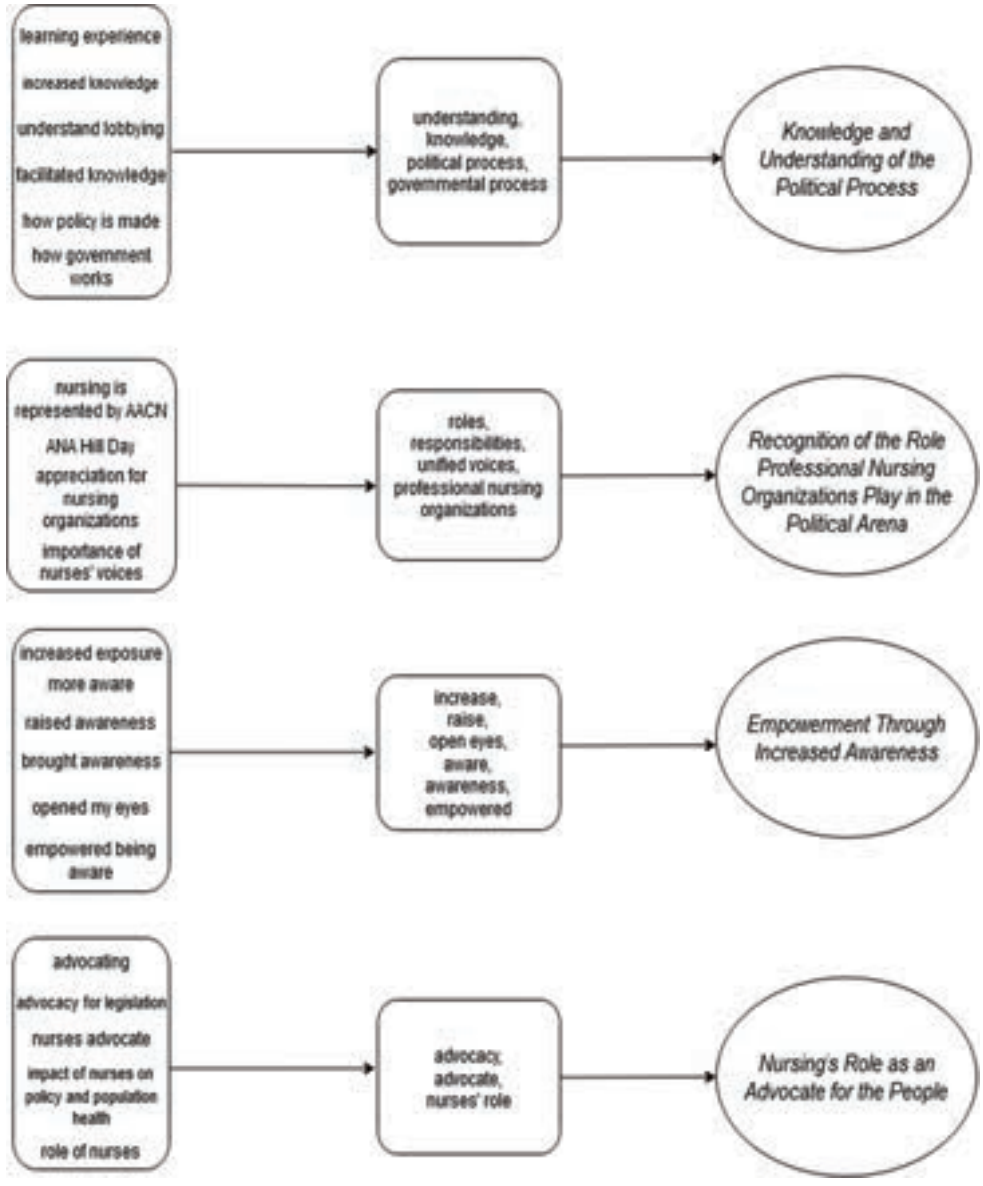
Data Analysis

As explained by van Manen (1997), data analysis involves the reflection on essential themes that characterize the phenomenon. In this study, the authors utilized Colaizzi's (1978) and van Manen's (1997) phenomenological methods, along with aid of NVivo 12 Pro for Windows, a qualitative data analysis software, for analysis. Each participant's written response to the question was read and re-read. Significant written responses were extracted and identified as Level I codes. The researchers continuously

compared new Level I codes with those previously identified. Broader codes, labeled Level II, were meanings from significant statements condensed from basic codes (Level I). General themes and patterns came from interrelated and condensed Level II codes. The researchers then used these themes to formulate generalities from individual participants and as a group.

The flowchart shows the themes identified from the participants' responses (Figure 4). It also illustrates the hierarchical process of condensing and identifying the themes that emerged. Extracted significant statements were denoted as Level I. The meanings of Level I statements were formulated and shown as Level II. The final step was the identification of themes that emanated from formulated meanings, and these themes appear as Level III. The following themes emerged: *1) Knowledge and Understanding of the Political Process; 2) Recognition of the Role Professional Nursing Organizations Play in the Political Arena; 3) Empowerment through Increased Awareness; and 4) Nursing's Role as an Advocate for the People.* Additional themes noted to be of lesser extent may be the result of the varying itineraries of the participants' immersion experience as described in the research limitations. These included National Institutes of Health (NIH) and the healthcare process and policy. All respondents described their experience in a positive manner, with some participants using words such as "wonderful" (R1, R14, R15), "great" (R2), and "awesome" (R1, R5, 12). Also noted was interest in future engagement in policy. One participant stated, "In addition, I am more interested in policy and correlate that with my experiences" (R13).

Figure 4
Analysis of Themes Flowchart



Knowledge and Understanding of the Political Process

Because nurses are clinically engaged in day-to-day patient care roles, they are not engaged or knowledgeable in health policy processes and the political arena (Catallo et al., 2014). Participation in the healthcare policy immersion during the ANA Hill Day raised the students' awareness and appreciation of the political process. One participant said, "The experience gave me increased knowledge on the political process" (R8). Others stated, "The exposure…in just how government works." (R2); the experience provided a way "… to understand all that goes into lobbying…" (R7); "It was a wonderful learning experience…" (R11).

Recognition of the Role Professional Nursing Organizations Play in the Political Arena

Professional organizations, such as the ANA, have mandates and processes to engage nurses in policy development (Catallo et al., 2014). As part of political advocacy, doctoral nursing student participants in the health care policy immersion trip had the opportunity to participate in ANA's Hill Day. The participants in the study described their recognition of the integral role that professional organizations play. "I have a greater appreciation for the various nursing organizations...and what they do" (R7); "… seeing how nursing is represented by [the American Association of Colleges of Nursing] AACN" (R2); "…showed me how important nurses' voices are…we need that seat at the table" (R5).

Empowerment through Increased Awareness

Empowerment, a central concept in health promotion, denotes working with communities to enable them to identify and achieve their goals (Carter, 2017). The overall experience, as stated by participants, was "…very valuable and empowering" (R15); "It raised my awareness….and it showed me how important nurses' voices are in changing old or implementing new policies" (R5); "…opened my eyes…" (R6); "…made me more aware and more interested" (R2).

Nursing's Role as an Advocate for the People

Nursing has historically advocated to impact health policy, particularly for various vulnerable populations. This immersion experience afforded students an increased awareness and understanding that further action on their part will be required for the betterment of society. As stated by one participant, "…I have become more aware of advocacy…related to the concerns impacting professional nursing, population health and healthcare in general" (R8); "…brought awareness to the impact nurses have and can have…" (R13); "The trip was a great way to learn to advocate….to speak with [legislators]….lobbying on our behalf" (R7); "It showed me the importance of…making a hill visit" (R10).

Discussion

The participants of this study described the lived experience of their immersion trip to Washington, D.C. The emerging themes of this study revealed that by way of health policy education and an immersion experience, doctoral students' gained knowledge and understanding of the political process, as well as an awareness to serve as advocates through political involvement. In addition, a sense of empowerment through increased awareness emerged. These doctoral nursing students also described their recognition of the paramount role that professional nursing organizations play in the political arena.

Although there are approximately four million registered professional nurses currently active in the United States, comprising the largest group in the healthcare workforce, nurse advocacy for health policy continues to remain low (Catallo et al., 2014; National Council of State Boards of Nursing, 2018). Nurses play a critical role in their patients' journey along the healthcare continuum. This frontline presence allows nurses firsthand knowledge of the challenges that individuals encounter as they navigate the healthcare system (American Nurses Association [ANA], n.d.). Two landmark documents, the IOM *Future of Nursing Report* (2010) and the ANA *Code of Ethics* (2015) both emphasize the importance of nurses capitalizing on their unique role in healthcare in order to advance the nursing profession. Nursing knowledge and experience influence health policy and its processes (Lewinski & Simmons, 2018).

According to Wakefield (2004), health policy is developed without evidential support from nursing research. Ellenbecker & Edward (2016) maintain that "by increasing nurse researchers' understanding of the policy process and how research contributes to each stage, nurse researchers will be more effective in contributing to policies that improve the health of the nation" (p. 208). Research demonstrates that nurses require, yet do not often receive, education and training regarding advocacy in health policy (DiCenso et al., 2012; Heiman et al., 2016; Lewinski & Simmons, 2018). This study shows that health policy education and a Washington D.C. immersion experience can elevate nurses' health policy knowledge and can promote future political involvement.

Limitations

This research is subject to several limitations. With the exception of ANA Hill Day, the itineraries of the Washington, D.C. immersion experiences varied with each group of doctoral nursing students. This inconsistency between groups may have influenced each participant's interpretation of their experience. The next limitation was the use of an electronic survey for data collection. This approach, though convenient, does not allow for direct questioning, observation, and additional clarifying questions by the researcher. Although participants responded to open-ended questions, the written responses may not be fully descriptive and therefore may not express their experiences accurately. There was also an inability to validate the statements of the participants, due to the anonymous nature of the email survey format. Lastly, the potential for bias exists since all the researchers participated in the immersion and bracketing of that personal experience had to be acknowledged and maintained throughout the analysis process. (Creswell, 2013; Creswell, 2014).

Implications for Nursing

In order for political engagement of nurses to occur, an increase in exposure to health policy through education is paramount. Nurses often cite a lack of political awareness, including the internal workings of the government and how policy decisions are made (Abood, 2007; Cramer, 2002). Nurse leaders who work with professional nursing organizations and nurse educators need to cultivate greater political interest and engagement, beginning with undergraduate level nursing students and continuing with practicing nurses (Deschaine & Schaffer, 2003; Duncan et al., 2012; Vandenhouten et al., 2011). The relevance of a health policy course in the nursing curriculum must be emphasized at the undergraduate and graduate levels. This will facilitate political engagement by broadening student awareness of current health policy issues and the processes involved to address these problems. Professional nursing organizations can play a role in providing ongoing continuing education for nurses in practice to address knowledge gaps (Vandenhouten et al., 2011). Educational strategies can focus on raising nursing awareness of the typical pressures faced in a policy environment, such as its fast-paced nature, multiple competing priorities, limited time to make consequential decisions, and a need for relevant evidence for appropriate decision-making (Catallo & Sidani, 2014). With a better understanding of the policy process and arena, including the pressures surrounding decision-making and multiple competing drivers, nurses can identify and develop a role that facilitates ongoing political engagement. Some examples of learning opportunities for nurses include activities that support the articulation of a current health problem using a nursing and policy lens, identifying options that policymakers deem relevant within the broader health system to address nursing or policy problems, and describing local implementation considerations in a succinct manner. These areas of focus are consistent with international initiatives such as the *SUPporting POlicy relevant Reviews and Trials (SUPPORT) Project* (Lavis et al., 2009), which are tools for evidence-informed health policymaking with relevance to healthcare system stakeholders.

Conclusion

This study examined the lived experience of a small purposive sample of doctoral nursing students who participated in a week-long health policy immersion as a requirement in a health policy course. All the participants reported positive feedback. Themes that emerged from the study include participants' appreciation of the political process, recognition of professional nursing organizations' roles, empowerment by way of heightened awareness, and nurses' role as advocates for the population. Primono (2007) explains that political advocacy is a component of the nurses' role in health promotion, nurses' active participation in health policy development, and the inclusion of policy and advocacy aspects in nursing curricula will help nurses realize their full potential as healthcare advocates. Nurses possess a wide array of knowledge and expertise regarding the care of patients (Phillips, 2012). Through increased knowledge and awareness, doctorally-prepared nurses will engage in the political arena and actively participate in advocacy efforts to improve health policy and the health of individuals, communities, and populations.

References

Abood, S. (2007). Influencing health care in the legislative arena. *OJIN: The Online Journal of Issues in Nursing, 12*(1), Manuscript 2. https://dx.doi.org/10.3912/OJIN.Vol12No01Man02

American Nurses Association. (n.d.). *Health policy*. https://www.nursingworld.org/practice-policy/health-policy

American Nurses Association. (2015). *Guide to the code of ethics for nurses with interpretive statements: Development, interpretation, and application* (2nd ed.). American Nurses Association.

Carter, S. M. (2017). Ethics and health promotion. In S. R. Quah (Ed.), International Encyclopedia of Public Health (2nd ed., pp. 1-6). Academic Press.

Catallo, C., & Sidani, S. (2014). The self-assessment for organizational capacity instrument for evidence-informed health policy: Reliability and validity of an instrument. *Worldviews on Evidence-Based Nursing, 11*(1), 35-45. https://dx.doi.org/10.1111/wvn.12018.

Catallo, C., Spalding, K., & Haghiri-Vijeh, R. (2014). Nursing professional organizations: What are they doing to engage nurses in health policy? *SAGE Open, 4*(4), 1-9. https://dx.doi.org/10.1177/2158244014560534

Cohen, S. S., & Milone-Nuzzo, P. (2001). Advancing health policy in nursing education through service learning. *Advances in Nursing Science, 23*(3), 28-40.

Colaizzi, P. F. (1978). Psychological research as the phenomenologist views it. In R. S. King (Ed.), *Existential-phenomenological alternatives for psychology* (pp. 48-71). Oxford University Press.

Cramer, M. E. (2002). Factors influencing organized political participation in nursing. *Policy, Politics, & Nursing Practice, 3*(2), 97-107. https://dx.doi.org/10.1177/152715440200300203

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). SAGE Publication Inc.

Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publication Inc.

Deschaine, J. E. & Schaffer, M. A. (2003). Strengthening the role of public health nurse leaders in policy development. *Policy, Politics, & Nursing Practice, 4*(4), 266-274. https://dx.doi.org/10.1177/1527154403258308

DiCenso, A., Housden, L., Heale, R., Carter, N., Canitz, B., MacDonald-Rencz, S., & Buckley, C.R. (2012). Incorporating a health policy practicum in a graduate training program to prepare advanced practice nursing health services researchers. *Policy, Politics, and Nursing Practice, 13*(4), 224-233. https://dx.doi.org/10.1177/1527154413484067

Duncan, S. M., Thorne, S., Van Neste-Kenny, J., & Tate, B. (2012). Policy analysis and advocacy in nursing education:

The nursing education council of British Columbia framework. *Nurse Education Today, 32*(4), 432–437. https://dx.doi.org/10.1016/j.nedt.2011.03.009

Ellenbecker, C. & Edward, J. (2016). Conducting nursing research to advance and inform health policy. *Policy, Politics, & Nursing Practice, 17*(4), 208-217. https://dx.doi.org/10.1177/1527154417700634

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods, 18*(1), 59-82. https://dx.doi.org/10.1177/1525822X05279903

Heiman, H. J., Smith, L. L., McKool, M., Mitchell, D. N., & Roth Bayer, C. (2015). Health policy training: A review of the literature. *International Journal of Environmental Research and Public Health, 13*(1), 1-12. https://dx.doi.org/10.3390/ijerph13010020

Hinshaw, A. S., & Grady, P. A. (Eds.). (2011). *Shaping health policy through nursing research.* Springer Publishing Company.

Institute of Medicine. (2003). *Who will keep the public healthy? Educating public health professionals for the 21st century*. The National Academies Press. https://dx.doi.org/10.17226/10542

Institute of Medicine. (2010). *The future of nursing: Leading change, advancing health*. The National Academies Press.

Institute of Medicine. (2011). *For the public's health: Revitalizing law and policy to meet new challenges*. The National Academies Press.

Jansson, B. S., Nyamathi, A., Heidemann, G., Duan, L., & Kaplan, C. (2015). Validation of the policy advocacy engagement scale for frontline healthcare professionals. *Nursing Ethics*. https://dx.doi.org/10.1177/0969733015603443

Lavis, J. N., Permanand, G., Oxman, A. D., Lewin, S., & Fretheim, A. (2009). SUPPORT tools for evidence-informed health Policymaking (STP) 13: Preparing and using policy briefs to support evidence-informed policymaking. *Health Research Policy and Systems, 7*(1), 1-9. https://dx.doi.org/10.1186/1478-4505-7-S1-S1

Lewinski, A. & Simmons, L. (2018). Nurse knowledge and engagement in health policy making: Findings from a pilot study. *The Journal of Continuing Education in Nursing, 49*(9), 407-415. https://dx.doi.org/10.3928/00220124-20180813-06

Mou, D., Sarma, A., Sethi, R., & Merryman, R. (2011). The state of health policy education in U.S. medical schools. *The New England Journal of Medicine, 364*(10), e19(1-3). https://dx.doi.org/10.1056/nejmp1101603

National Council of State Boards of Nursing. (2018). *Nursing regulation*. https://www.ncsbn.org/boards.htm

Phillips, C. D. (2012). Nurses becoming political advocates. *Journal of Emergency Nursing, 38*(5), 470-471. https://dx.doi.org/10.1016/j.jen.2012.05.022

Primomo, J. (2007). Changes in political astuteness after a health systems and policy course. *Nurse Educator, 32*(6), 260-264, https://dx.doi.org/10.1097/01.NNE.0000299480.54506.44

Primomo, J., & Björling, E. A. (2013). Changes in political astuteness following nurse legislative day. *Policy, Politics, and Nursing Practice, 14*(2), 97-108. https://dx.doi.org/10.1177/1527154413485901

Russo, P. (2015). Population Health. In J. R. Knickman & A. R. Kovner (Eds.), *Jonas & Kovner's health care delivery in the United States*, (pp. 79-97). Springer.

United States Department of Health & Human Service. (2010). *Healthy people 2020: An opportunity to address societal determinants of health in the united states*. https://www.healthypeople.gov/2010/hp2020/advisory/SocietalDeterminantsHealth.htm

van Manen, M. (1997). *Researching lived experience: Human science for an action sensitive pedagogy*. Routledge.

Vandenhouten, C. L., Malakar, C. L., Kubsch, S., & Block, D. (2011). Political participation of registered nurses. *Policy Politics & Nursing Practice, 12*(3), 159-67. https://dx.doi.org/10.1177/1527154411425189

Wakefield, M. (2004). Linking health policy to nursing and health care scholarship: Points to consider. *Nursing Outlook, 52*(2), 111-113. https://dx.doi.org/10.1016/j.outlook.2004.01.001

World Health Organization. (2018). Health Topics: Health Policy. http://www.who.int/topics/health_policy/en/

ORIGINAL RESEARCH

An Integrative Review of Causes, Manifestations and Evaluation of Cognitive Fatigue among Persons with Multiple Sclerosis

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Abstract

Background: Fatigue is the most distinguishing symptom for patients with Multiple Sclerosis (MS) and for some of these patients it can be quite disabling. Studies exploring MS-related fatigue have differentiated this into various dimensions: motor, cognitive, physical, psychosocial, performance, and subjective. It is the cognitive dimension that can have serious consequences such as loss of vocation, independence, and possibly, more relapses or worsening of the disease.

Objective: The aims of this integrative review were to explore the advances in understanding cognitive fatigue in MS, as well as its causes and manifestations, and to identify the objective methodologies that best measure cognitive fatigue in MS.

Methodology: An integrative review of the scientific literature was performed using methods and criteria following the PRISMA-P2015 guidelines for data extraction. The studies were critically appraised using the Rapid Critical Appraisal and the qualitative study method of Constant Comparison.

Results: Twenty-three studies (2010-2019) were identified from the United States and other countries. The majority of articles were published within the last three years. Evaluation of outcomes from these studies was conducted through self-reporting. Cognitive fatigue may result in more relapses among those with relapsing and remitting MS and from those with secondary progressive MS. Cognitive fatigue and physical fatigue should be considered distinct domains.

Conclusion and Recommendations: An increasing number of studies focused on cognitive fatigue, however, there is no standard definition or conceptual framework available to understand this phenomenon. Various methodologies were identified to evaluate cognitive fatigue. Additionally, there should be a valid, reliable, and readily available instrument for use in the clinical setting.

Keywords: Multiple Sclerosis, Cognitive Fatigue, Fatigue, Integrative Review

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An Integrative Review of Causes, Manifestations and Evaluation of Cognitive Fatigue among Persons with Multiple Sclerosis

Multiple Sclerosis (MS) is a disease that is life-long, chronic and affects motor and cognitive functions with characteristic progressive multifocal deficits affecting the central nervous system (Marshall & Mayer, 2007). This disease is a prevalent cause of disability for adults between 30 – 50 years of age, and affecting females close to three times more frequently than males (Halper & Harris, 2017; Marshall & Mayer, 2007). It is also unclear why populations in the United States north of the 37th parallel of the Earth's equatorial plane have a higher risk of developing MS (Halper & Harris, 2017).

Pathophysiology

The etiology of MS is unknown, however, it is considered an autoimmune disease because of the presence of inflammation within damaged myelin nerve fibers (Marshall & Mayer, 2007). Defining characteristics of MS are distinct – firm plaques occurring in the brain white matter and spinal cord, changes in important neurotransmitter concentrations, and brain atrophy as seen on magnetic resonance imaging (MRI) (Marshall & Mayer, 2007). In a large multi-site study of MS patients with fatigue and low disability scores, researchers concluded from MRI scan results that independent of disability, white and grey matter brain atrophy is a risk factor for fatigue in MS (Tedeschi et al., 2007).

Fatigue

Fatigue is the most common disabling symptom in MS affecting over 80% of persons with MS. For many it is the most challenging to manage on a daily basis, and 40% of those with MS consider it their most disabling symptom resulting in decreased quality of life and a significant reason for forfeiture of a vocation or employment (Blikman et al., 2018; Braley & Chervin, 2010; Halper & Harris, 2017; Marshall & Mayer, 2007; Morrison & Stuifbergen et al., 2016; Tedeschi et al., 2007; Touzet, 2017; Vaughn, et al., 2018; Walker et al., 2019). The purpose of this integrative review was to understand new developments about the dimensions of cognitive fatigue, especially its causes and evaluations, in order to detect its manifestations and intervene accordingly.

Defining Fatigue

Fatigue in the general population is described as an overpowering sense of exhaustion resulting in less reserves for physical and mental work at a person's usual level of functioning (Given & Sherwood, 2006). Researchers have regarded general fatigue as an individual subjective phenomenon that is described as a shortage of energy after engaging in physical or mental activities and is usually measured by self-report (Walker et al., 2019). MS fatigue has been defined by the Multiple Sclerosis Council for Clinical Practice Guidelines (Blikman et al., 2018) as being associated with a person's physical behavior, daily physical functioning, and activities accomplished in daily life. However, the various dimensions of fatigue in MS are not yet well defined.

Dimensions of Fatigue

Throughout the years the concept of fatigue evolved to be two-dimensional: motor and cognitive (Claros-Salinas et al., 2012). Recently, however, other dimensions have gone through some iterations, e.g., the dimensions of fatigue changed from motor to physical and included a psychosocial element (Morrison & Stuifbergen, 2016). Aldughmi et al. (2017) described the various dimensions as perceived physical, cognitive and the addition of performance fatigue. Blikman et al. (2018) described four components of fatigue as physical, cognitive, psychosocial and added a subjective dimension. Blikman et al. (2018) derived the four dimensions from the subscales of two multi-dimensional fatigue self-report questionnaires: Checklist Individual Strength (CIS20r) and Modified Fatigue Impact Scale (MFIS).

Cognitive Fatigue

Cognitive fatigue is included within the dimensions of MS fatigue. However, Berard et al. (2018) stated that there is no unanimous definition for cognitive fatigue. The authors defined it as the "inability to maintain optimal task performance throughout a sustained attention task" (Berard et al., 2018, p. 55). Moreover, cognitive fatigue is a collection of multiple deficits resulting in decreased functions of alertness, focused attention and reduced mental processing of information (Berard et al., 2018).

Hanken et al. (2015) concluded that MS fatigue maybe the feeling related to the inflammation occurring in the nerves that is evident in the person's behavior if they need to rely on distinct cognitive processes. The feeling that Hanken et al. (2015) described in MS fatigue distracts the person's attention away from the cognitive processes of the moment. This is similar to feeling pain that distracts a person's attention. The researchers further explained that the feeling of fatigue with the reduced behavioral outcomes may be caused by brain atrophy that occurs in MS or the neurochemical imbalances affecting alertness and vigilance (Hanken et al., 2015).

Objective Measures

As research evolved related to MS, questionnaires were developed for self-reporting with attempts to quantify fatigue and evaluate its impact on day to day functioning for persons with MS (Walker et al., 2019). Walker et al. (2019) listed scales that were developed between 1989 and 2012, e.g., Fatigue Severity Scale, Fatigue Impact Scale, Neurological Fatigue Index, Mental Fatigue Scale, Fatigue Assessment Scale, Multidimensional Fatigue Inventory, and the Fatigue Scale for Motor and Cognitive Functions. Objective measurement leads to quantification of cognitive fatigue, thereby, positively impacting disability benefits for people afflicted with MS related cognitive fatigue (Walker et al., 2019). Harrison et al. (2017) summarized various measures of cognitive fatigue in MS. They agreed that self-reporting is important among people with MS because it is their perception of the fatigue impact on their lives. Harrison et al. (2017)

recommended that these measures be further explored and improved.

Berard et al. (2018) suggested that the current state of the science for measuring MS related cognitive fatigue objectively is the Paced Auditory Serial Addition Test (PASAT) as a sensitive and valid tool. The PASAT compares initial task performance with later performances. People with MS are expected to have decreased performances as the task is measured over time because it becomes more difficult to quickly process necessary information for task completion (Berard et al., 2018). Touzet (2017) described direct methodologies to objectively identify cognitive fatigue with functional magnetic resonance imaging (fMRI), whereby patients with MS engage in cognitive tasks during fMRI scans. The MRI scans resulted in altered cerebral activations that were not seen among healthy control cohorts. Touzet (2017) also noted that diffuse tensor imaging (DTI) scans demonstrated a pattern of cerebral activities for patients who had self-reporting of increased fatigue on the Fatigue Severity Scale.

Methods

The adherence to ethical considerations for this integrative review was determined by previously conducted experimental, quasi-experimental, and non-experimental studies whose authors received Institutional Review Board approval. The methods and criteria for study followed the PRISMA-P2015 (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) checklist and guideline recommendations of components such as population, intervention, comparison, and outcome (PICO) (Moher et al., 2015) (Table 1).

Table 1

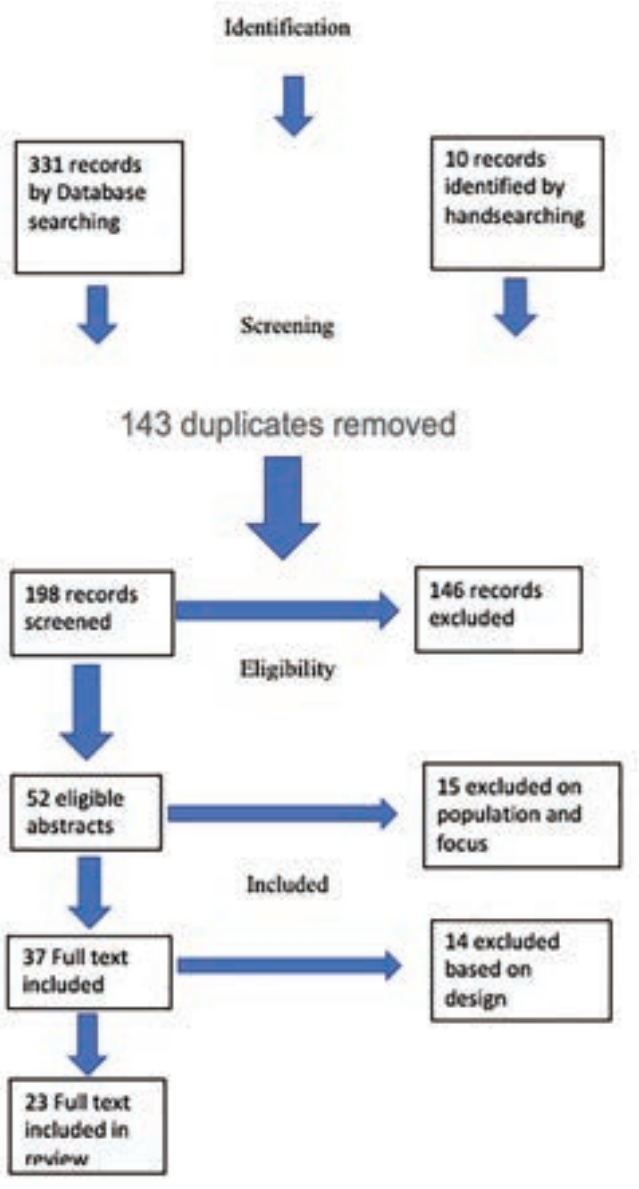
Problem, Intervention, Comparison and Outcome (PICO) Strategy[a]

Element	Description
Patient	Adults with all types and subtypes of multiple sclerosis (MS)
Problem	Fatigue is not a well understood symptom. There is general fatigue related to daily living factors such as inadequate sleep or depression. There is also disease related fatigue of which in MS it is a common symptom. Evidence has been increasing that the subjective feeling of fatigue in MS has distinct components, physical and cognitive[b]. Research around the concepts of cognitive fatigue and cognitive fatigability are evolving and needs more inspection as these may impact quality of life and treatment approaches in MS.[c]
Intervention	Observe/Screen for the advancement in knowledge of the causes, evaluation and manifestations of cognitive fatigue in patients with MS
Comparison	Those patients who develop other identified dimensions of fatigue and cognitive impairment.
Outcome	Updated developments in the cause, evaluation and manifestations of cognitive fatigue.
Inclusion Criteria	Adults, all genders identified and not identified, ages 18-89 years, who have all types and subtypes of MS from any world population. Studies: Descriptive, reports, mixed-methods, longitudinal, experimental and quasi-experimental.
Exclusion Criteria	Less than 18 years of age or older than 89 years old. Studies more than 15 years old (2003 and older). Foreign language.
Question	What has been discovered in the last 15 years concerning the causes, evaluations and manifestations of cognitive fatigue?
Type of Problem	Prognostic value
Type of Study	Integrative Review
Main Topics and Alternative Terms	Cognitive fatigue, fatigue, physical fatigue, relapsing/remitting multiple sclerosis, progressive symptoms, multiple sclerosis
Plan to Search	Databases: CINAHL, PubMed, Web of Science, Medline via Web of Science, Science Direct. Handsearching through electronic libraries of University at Buffalo The State University of New York

[a]Moher et al., 2015 [b]Gullo et al., 2019 [c]Walker et al., 2019

The integrative literature review was conducted with the expert assistance of the professional medical librarian associated from the university's school of nursing. The search strategy is shown in Figure 1 in a diagram format using the PRISMA guidelines (Moher et al., 2009).

Figure 1
PRISMA Flow of Information Diagram



A literature search was performed using CINAHL, PubMed, Web of Science, Medline via Web of Science, and Science Direct databases. Patients with MS that showed a pattern of relapsing-remitting MS (RRMS) were included in the search because 85% of patients have this feature (Marshall & Mayer, 2007). Relevant articles were searched using keywords and Boolean operators OR and AND in various combinations as shown in Table 2. The search strategy identified 331 potential articles. Hand search of systematic reviews (Walker et al., 2019) added nine titles and an additional study by Vaughn et al. (2018). The author of this integrative review attended a lecture presentation given by Vaughn and found the article written by her and her colleagues relevant to this review.

Table 2
Search Concepts and Boolean Operators

Concept	Boolean	Concept	Boolean	Concept
Cognitive Fatigue	OR	Physical Fatigue	AND	Relapsing Remitting Multiple Sclerosis
Cognitive Fatigue	AND	Physical Fatigue	OR	Relapsing Remitting Multiple Sclerosis
Relapsing Remitting Multiple	AND	Progressive Symptoms		
Physical Fatigue	AND	Relapsing Remitting Multiple Sclerosis		
Physical	AND	Cognitive Fatigue in Multiple Sclerosis		
Relapsing Remitting Multiple Sclerosis				
Cognitive Fatigue				

The ten hand searched studies accounted for a total of 341 research identified. After removal of duplicates and foreign language articles, 198 studies were left to review. Titles and abstracts of the remaining articles were screened for inclusion. This yielded fifty-two eligible abstracts and excluded 15 based on the set criteria. The remaining thirty-seven articles were filtered to only those that are full text. Fourteen publications were excluded, leaving 23 studies for the final analysis (Table 3 at end of this article).

Quality Review

The 23 research studies were reviewed using a Rapid Critical Appraisal method to evaluate the validity of the instruments used to measure the outcomes (Mazurek Melnyk et al., 2010). The results were reliable and most of the studies were descriptive cohort designs. Lastly, those included needed to be inclusive of patients with various types of MS (relapsing remitting, primary and secondary progressive) with a focus on fatigue and cognitive fatigue.

The studies were further evaluated using the qualitative study method of Constant Comparison (Charmaz, 2012) and the extracted data were compared and subsequently categorized by theme, type of fatigue, type of MS, participant number and ages,

study design, presence of a theoretical framework, and research outcomes (Table 3). Finally, the 23 studies were organized, filed and stored in a software tool for managing bibliographies.

Study Descriptive Statistics

Of the 23 studies, seven originated in the United States and the majority (n=16) were international studies. Those that came from other countries included Germany (n=5) and Canada (n=3). The research studies spanned over nine years from 2010 to 2019. Fifteen of the studies (65%) were published within the last three years: 2019 (n=6), 2018 (n=6), and 2017 (n=3). The majority of the researchers focused on the manifestation of fatigue (52%, n=12) while there were five studies (22%) that explored its causes.

Type of Fatigue

The studies were varied in the type of fatigue that was examined. An increase in research activity about fatigue and its dimensions is evident because 65% of the 23 studies were published from 2017 to 2019. Cognitive fatigue has been consistently included in the literature as a dimension and a factor of discussion in 20 of the 23 studies from this review. The remaining three studies focused on general fatigue, motor or physical fatigue, and cognitive performance.

Study Designs

The predominant research design used consisted of cohort studies (n=11) using convenience samples from MS centers or clinics. Fatigue was measured through a variety of self-reporting questionnaires and the most frequently used was the Modified Fatigue Impact Scale because it offered a multidimensional assessment (Braley & Chervin, 2010; Colbeck, 2018; Golan et al., 2018; Gullo et al., 2019; Morrison & Stuifbergen, 2016; Vucic et al., 2010). There were three studies that compared scores on self-reporting questionnaires with MRI scans (Sander et al., 2016; Touzet, 2017; Wilting et al., 2016). One cohort study tested participants fatigue using a wearable device called an accelerometer and the data were downloaded and analyzed by a specific software (Blikman et al., 2018). Another study utilized a naming exercise, Block Cyclic Naming Task, in researching MS cognitive fatigue (Cehelyk et al., 2019). Two studies were systematic reviews (Hanken et al., 2015; Walker et al., 2019). Three studies were longitudinal, ranging from three to six years (Berard et al., 2018; Damasceno et al., 2019; Golan et al., 2018).

Outcomes

The research studies discussed causes of cognitive fatigue resulting from central nervous system dysfunction, damage from the disease process, abnormal hormone levels, and immunological functioning with associated conditions such as sleep disorders, depression and difficulties with sensory processing (Braley & Chevin, 2010; Colbeck, 2018; Hinz et al., 2018; Jason et al., 2010; Rooney et al., 2019; Vucic et al., 2010). Hinz et al. (2018) strongly recommended that gender should be included in developing and analyzing scales that evaluate fatigue. Moreover, these researchers reported that female patients reported more incidence of fatigue than males in all three dimensions: physical, emotional and cognitive. Wilting et al. (2016) concluded from MRI scans and morphologic analyses among patients with a recent diagnosis of RRMS and cognitive fatigue showed changes in the thalamic region of their brains compared to similar patients who did not exhibit cognitive fatigue. Aldughmi et al. (2017) used instruments that evaluated activities of daily living and how associated tasks were causing fatigue to participants with MS. This illustrates how much a person with MS is struggling on a daily basis with ordinary, usual functions. Other researchers (Yalachkov et al., 2019) found no significant effect on cognitive or motor fatigue in the quality of life of patients with RRMS and primary and secondary progressive MS.

In their longitudinal study, Berard et al. (2018) found that early in the diagnosis of MS, patients are vulnerable to cognitive fatigue. However, patients seen in the clinic setting are often assessed only for physical task performance or motor fatigue. The researchers concluded that cognitive effort should also be assessed in the clinic setting. Both cognitive and physical fatigue should be considered as separate domains during assessments (Berard et al., 2018).

Sander et al. (2016) divided MS participants (RRMS and Secondary Progressive) – those with fatigue and those without, and tested them using the Fatigue Scale for Motor and Cognition and had MRI scans. An analysis was performed to determine the relevance of the participants' cognitive fatigue status in relation to the number of MS relapses over 17 months and the MRI results. The researchers concluded that patients with cognitive fatigue developed increased brain atrophy and MS relapses than those without cognitive fatigue, suggesting an aggressive inflammation not typically seen in patients with MS (Sander et al., 2016).

Discussion

The most important finding related to this integrative review was related to the most prevalent type of MS, the RRMS type, where there are recurring relapses with the increased risk of progression to a more severe form (Halper & Harris, 2017). RRMS patients need to adhere to their medication regimen to prevent this progression. A possible explanation for questionable medication adherence is the physical and cognitive struggle of MS patients to function while suffering from fatigue that medication adherence may not be possible (Aldughmi et al. 2017).

At the time of diagnosis, sixty percent of MS patients are employed and the highest incidence of MS onset is between the ages of 20 and 40 years of age (Halper & Harris, 2017). These are adults in the prime of their lives and it is imperative to have the resources and research data regarding extra social benefits necessary to assist them to function optimally.

The weakness of the research about fatigue and cognitive fatigue is that there is a lack of a clear conceptual framework for the study of fatigue in neurological conditions (Walker et al., 2019). One study out of 23 outlined a theoretical basis for the research (Colbeck, 2018). In addition, there is no unified and objective definition for cognitive fatigue (Berard, 2018).

Many of the research in this review were cohort and control studies and the sampling were purposeful or convenience in nature. Purposeful sampling is a type of non-probability sampling where participants are those who meet the needs of the study and they are not randomized (Shadish et al., 2002). Samples were

recruited through a MS center or known MS clinic of a neurology department of a university affiliated facility. This sampling method affects external validity and generalization of results. Additionally, studies in this integrative review did not employ randomization of samples in experimental and control groups. According to Shadish et al. (2002) this affects the validity of the studies as random assignment supports internal validity.

Two important therapies that were not accounted for by the studies were complementary and alternative therapies such as meditation and relaxation techniques. MS care teams suggested to incorporate these into patients' lives, if at all indicated (Halper & Harris, 2017). The inclusion of medical marijuana and other alternative therapies may have had confounding effects on the study outcomes related to fatigue but were not explored.

Future research could use a tested theoretical framework to guide the studies. This will give more support in the development of a universal definition for cognitive fatigue in MS. In addition, three studies used a controlled methodology but without random assignment for experimental and control groups. Perhaps more randomized control methodologies could be employed to support validity of the studies.

Conclusion

Cognitive fatigue and MS are areas where more research is needed. The outcomes of the studies were encouraging in understanding cognitive fatigue, possible underlying causes, specific testing especially early in the diagnosis of MS, and the effects of specific types of fatigue that will influence clinical care. The research in cognitive fatigue has grown significantly in the last three to four years. More research is necessary in order to help patients with this dimension of MS fatigue.

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Table 3
Description of Extracted Study Data

First Author/ Year/Country	Theme	Type of Fatigue	Type of MS	Participants Number/Ages	Study Design Theory Framework	Outcomes
Aldughmi/2017/ USA	Fatigability & Perceived Fatigue Manifestation	Physical or cognitive	RRMS or secondary progressive	N = 52 Mean age 47 (SD 10 yrs.)	Cohort study No theoretical framework	Increased perceived fatigue is not always associated with decrease in performance
Berard/2018/ Canada	Cognitive impairment Manifestation	Cognitive	RRMS	N = 64 32 tested 32 control 18-65 yrs.	Longitudinal 3yr Case Cntrl No theoretical framework	Cognitive fatigue may be a sensitive maker of cognitive impairments
Blikman/2018/ Netherlands	Dimensions of fatigue Manifestation	subjective, physical, cognitive, psychological	RRMS, primary and secondary progressive,	N = 212 Ages 18-70yrs. Mean 48yrs.	Cohort study No theoretical framework	Physical behavior is not associated with other dimensions of fatigue
Braley/2010/ USA	Fatigue: multi-factorial Cause	Physical, cognitive, chronic	All types/ subtypes	No specific sample	Descriptive review of rating instruments No theoretical framework	Identify treatable causes to have a positive effect in the lives of PwMS
Cehelyk/2019/ USA	Fatigue and fatigability Evaluation	Physical, cognitive, objective, subjective	All MS types/ subtypes and all disabilities	N = 20 Ages >18 yrs. Mean 43 yrs. (SD 10 yrs)	Cohort study No theory	Association between subjective and objective cognitive fatigue in patients with MS

Claros-Salinas/2012/ German	Induced cognitive fatigue Manifestation	Cognitive	All types/ subtypes with cognitive fatigue	N = 32 w/ MS and N=20 healthy controls Mean age 47yrs. (SD 9 yrs.)	Control trial w/o random No theory	Cognitive load induces cognitive fatigue
Colbeck/2018/ Canada	Sensory over responsiveness Cause	Cognitive	All MS types / subtypes	N = 30 Ages > 18 years	Cohort study Theory Dunn's Model of Sensory Processing	Sensory processing preferences helps influence cognitive fatigue
Damasceno/2019 /Brazil	Cognitive impairment Manifestation	Cognitive	RRMS	N = 42 w/RRMS 30 healthy control Ages 31 (SD 7 years)	Longitudinal Control w/o random 6yrs No theory	Cognitive impairment at baseline was the best predictor of both physical and cognitive deterioration
Golan/2018/ USA	Impact fatigue on cognitive function Manifestation	Cognitive	RRMS, Secondary and Primary Progressive	N = 699 46 yrs. (SD 10.5yrs.)	Longitudinal Cohort study 6 yrs No theory	Do not attribute cognitive impairment to fatigue or mild depression in PwMS
Gullo/2019/ Australia	Daily function Manifestation	Cognitive and physical fatigue	All MS types / subtypes	N = 74 18-80 yrs. Mean age 53 yrs	Cohort study No theory	Cognitive and physical fatigue should be considered distinct domains
Hanken/2015/ German	Neuronal networks Evaluate	Fatigue and cognitive performance	All MS types / subtypes	No specific sample	Systematic review of descriptive studies	Include alerting /vigilance testing into clinical routine evaluation of MS patients experiencing fatigue
Harrison/2017/ British	Cognitive fatigability Evaluate	Cognitive	All MS types/ subtypes	No specific sample	Descriptive study No theory	Self-report instruments are a valid way to assess perception of fatigue and its' impact
Hinz/2018/ German	Fatigue Questionnaires Evaluate	Physical, emotional, and cognitive	Unknown General German Population	N = 2411 Male = 1121 Mean 49 yrs. Female = 1290 Mean 50 yrs.	Cohort study No theory	Consider gender when accounting for the amount and type of fatigue
Jason/2010/USA	Pathological and non-pathological Cause	Cognitive or physical	All MS types/ subtypes	No sample	Descriptive studies No theory	Lack of specific, comprehensive definition of fatigue

Morrison/2016/ USA	Predictors Manifestation	Physical, cognitive, psychosocial	All MS types/ Subtypes long-standing mean 26.5yrs	N = 331 35 to 89 years mean 63 yrs. (SD 9yrs)	Cohort study No theory	Depressive sx's was the strongest predictor of total and cognitive fatigue impact
Rooney/2019/ Scotland	Prevalence Cause	Physical, cognitive and psychological	Progressive and non-progressive	N = 412 Mean 46 yrs. SD 11.5yrs	Cohort study No theory	Fatigue more prevalent with progressive types of MS
Sander/2016/ Switzerland	Disease Progression Manifestation	Cognitive	RRMS and Secondary Progressive	N = 46 MS pts and 14 healthy control. Ages 18-46 yrs.	Control without randomization No theory	More relapses with cognitive fatigue
Touzet/2017/ France	Cortical inhibition Cause	Cognitive	All MS types/ Subtypes	No sample	Descriptive study No theory	Efficient NonREM sleep may be therapy against cognitive fatigue
Vaughn/2018/ USA	Fatigue at baseline manifestation	Fatigue	RRMS, Progressive MS	N = 2714 Mean age 45 yrs.	Cohort retrospective study No theory	Base line fatigue is associated with worsening disability
Vucic/2010/ Australia	Fatigue mechanisms cause	Motor sign fatigue	All MS types/ Subtypes	No sample	Descriptive study Author's own theory	Current evidence for fatigue in MS implies grey and white matter dysfunction & atrophy
Walker/2019/ Canada	Fatigability evaluation	Cognitive	All MS types/ Subtypes	No sample	Systematic Review No theory	Study of fatigue in neurological conditions lacks clear conceptual framework
Wilting/2016/ German	Provoking fatigue Evaluation	cognitive	RRMS, Primary progressive, secondary progressive	N = 32 Age 29-64 Mean 47 yrs. SD 9 yrs. N = 20 healthy controls	Control trial without Randomization No theory	Cognitive fatigue can be measured and assessed objectively
Yalachkov/2019 German	Quality of Life Manifestation	General fatigue, cognitive impairment	RRMS and Progressive (primary and secondary)	N = 55 Mean Age RRMS 38 SD 11 yrs. Mean Age Progressive 55 SD 11 yrs.	Cohort study No theory	There was no significant effect of cognitive or motor fatigue in quality of life

References

Aldughmi, M., Bruce, J., & Siengsukon, C.F. (2017). Relationship between fatigability and perceived fatigue measured using the neurological fatigue index in people with multiple sclerosis. *International Journal of MS Care,19,* 232-239. https://dx.doi.org/10.7224/1537-2073.2016-059

Berard, J. A., Smith, A. M., & Walker, L. A. S. (2018). A longitudinal evaluation of cognitive fatigue on a task of sustained attention in early relapsing-remitting multiple sclerosis. *Journal of MS Care, 20*, 55-61. https://dx.doi.org/10.7224/1537-2073.2016-106

Blikman, L. J. M., Van Meeteren, J., Rizopoulos, D., De Groot, V., Beckerman, H., Stam, H. J., & Bussmann, J. B. J. (2018). Physical behavior is weakly associated with physical fatigue in persons with multiple sclerosis-related fatigue. *Journal of Rehabilitation Medicine, 50*, 821- 827. https://dx.doi.org/10.2340/16501977-2375

Braley, T. J., & Chervin, R. D. (2010). Fatigue in multiple sclerosis: Mechanisms, evaluation and treatment. *SLEEP, 33*(8), 1061-1067. https://dx.doi.org/10.1093/sleep/33.8.1061

Cehelyk, E.K., Harvey, D.Y., Grubb, M.L., Jalel, R., El-Sibai, M.S., Markowitz, C.E., Berger, J.R., Hamilton, R.H., & Chahin, S. (2019). Uncovering the association between fatigue and fatigability in multiple sclerosis using cognitive control. *Multiple Sclerosis and Related Disorders, 27*, 269-275. https://dx.doi.org/10.1016/j.msard.2018.10.112

Charmaz, K. (2012). *Constructing grounded theory: A practical guide through qualitative analysis*. Sage.

Claros-Salinas, D., Dittmer, N., Neumann, M., Sehle, A., Spiteri, S., Willmes, K., Schoenfeld, M.A., & Dettmers, C. (2013). Induction of cognitive fatigue in MS patients through cognitive and physical load. *Neuropsychological Rehabilitation: An International Journal, 23*(2), 182-201. https://dx.doi.org/10.1080/09602011.2012.726925

Colbeck, M. (2018). Sensory processing, cognitive fatigue, and quality of life in multiple sclerosis. *Canadian Journal of Occupational Therapy, 85*(2), 169-175. https://dx.doi.org/10.1177/0008417417727298

Damasceno, A., Pimentel-Silva, L. R., Damasceno, B. P., & Cendes, F. (2019). Cognitive trajectories in relapsing-remitting multiple sclerosis: A longitudinal 6-year study. *Multiple Sclerosis Journal*, 1-12. https://dx.doi.org/10.1177/1352458519878685

Given, B. & Sherwood, P. (2006). Fatigue. In B.J. Ackley & G.B. Ladwig (Eds.), *Nursing diagnosis handbook a guide to planning care* (7th ed.). Mosby Elsevier.

Golan, D., Doniger, G.M.,Wissemann, K., Zarif, M., Bumstead, B., Buhse, M., Fafard, L., Lavi, I., Wilken, J., & Gudesblatt, M. (2018). The impact of subjective cognitive fatigue and depression on cognitive function in patients with multiple sclerosis. *Multiple Sclerosis Journal, 24*(2), 196-204. https://dx.doi.org/10.1177/1352458517695470

Gullo, H.L., Fleming, J., Bennett, S., & Shum, D.H.K. (2019). Cognitive and physical fatigue are associated with distinct problems in daily functioning, role fulfilment, and quality of life in multiple sclerosis. *Multiple Sclerosis and Related Disorders, 31*, 118-123. https://dx.doi.org/10.1016/j.msard.2019.03.024

Halper, J. & Harris, C. (2017). *Nursing practice in multiple sclerosis a core curriculum (4th ed.)*. Springer Publishing Company.

Hanken, K., Eling, P., & Hildebrandt, H. (2015). Is there a cognitive signature for MS-related fatigue? *Multiple Sclerosis Journal, 21*(4), 376-381. https://dx.doi.org/10.1177/1352458514549567

Harrison, A.M., das Nair, R., & Moss-Morris, R. (2017). Operationalising cognitive fatigability in multiple sclerosis: A Gordian knot that can be cut? *Multiple Sclerosis Journal, 23*(13), 1682-1696. https://dx.doi.org/10.1177/1352458516681862

Hinz, A., Weis, J., Brähler, E., & Mehnert, A. (2018). Fatigue in the general population: German normative values of the EORTC QLQ-FA12. *Quality of Life Research, 27*, 2681-2689. https://dx.doi.org/10.1007/s11136-018-1918-0

Jason, L.A., Evans, M., Brown, M., & Porter, N. (2010). What is fatigue? Pathological and non-pathological fatigue. *Physical Medicine and Rehabilitation, 2*, 327-331. https://dx.doi.org/10.1016/j.pmrj.2010.03.028

Marshall, R.S. & Mayer, S.A. (2007). Demyelinating and inflammatory disorders of the central nervous system. *On Call Neurology (3rd ed.)*. Saunders Elsevier.

Mazurek Melnyk, B., Fineout-Overholt, E., Stillwell, S.B., & Williamson, K.M. (2010). Evidence-based practice step by step: The seven steps of evidence-based practice. *American Journal of Nursing, 110*(1), 51-53. https://dx.doi.org/10.1097/01.NAJ.0000366056.06605.d2

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D.G., & The Prisma Group. (2009). Preferred reporting items for systematic review and meta-analyses: The PRISMA statement. *BMJ, 339*, b2535. https://dx.doi.org/10.1136/bmj.b2535

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L. A., & The Prisma-P Group. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews, 4*(1), 1-9. https://dx.doi.org/10.1186/2046-4053-4-1

Morrison, J.D. & Stuifbergen, A.K. (2016). Predictors of fatigue impact in persons with long-standing multiple sclerosis. *Journal of Neuroscience Nursing, 48*(3): 143-150. https://dx.doi.org/10.1097/JNN.0000000000000208

Rooney, S., Wood, L., Moffat, F., & Paul, L. (2019). Prevalence of fatigue and its association with clinical features in progressive and non-progressive forms of multiple sclerosis. *Multiple Sclerosis and Related Disorders, 28*, 276-282. https://dx.doi.org/10.1016./j.msard.2019.01.011

Shadish, W.R., Cook, T.D., & Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin Company.

Sander, C. Eling, P., Hanken, K., Klein, J., Kastrup, A., & Hildebrandt, H. (2016). The impact of MS related cognitive fatigue on future brain parenchymal loss and relapse: A 17-month follow-up study. *Frontiers in Neurology, 7*, 1-10. https://dx.doi.org/10.3389/fneur.2016.00155

Tedeschi, G., Dinacci, D., Lavorgna, L., Prinster, A., Savettieri, G., Quattrone, A. Livrea, P., Messina, C., Reggio, A., Servillo, G., Bresciamorra, V., Orefice, G., Paciello, M., Brunetti, A., Paolillo, A., Coniglio, G., Bonavita, S., Di Costanzo, A., Bellacosa, A., … Alfano, B. (2007). Correlation between fatigue and brain atrophy and lesion load in multiple sclerosis patients independent of disability. *Journal of Neuroscience, 263*(1), 15-19. https://dx.doi.org/10.1016/j.jns.2007.07.004

Touzet, C. (2017). Cognitive fatigue: An impaired cortical inhibitory replenishment. *Brain Injury, 8*, 1-7. https://dx.doi.org/10.1080/02699052.2017.1344300

Vaughn, C.B., Kavak, K.S., Dwyer, M.G., Bushra, A., Nadeem, M., Cookfair, D.L., Ramanathan, M., Benedict, R.H.B., Zivadinov, R., Goodman, A., Krupp, L., Motl, R.W., & Weinstock-Guttman, B. (2018). Fatigue at enrollment predicts EDSS worsening in the New York State Multiple Sclerosis Consortium. *Multiple Sclerosis Journal*, 1-10. https://dx.doi.org/10.1177/1352458518816619

Vucic, S., Burke, D., & Kiernan, M.C. (2010). Fatigue in multiple sclerosis: Mechanisms and management. *Clinical Neurophysiology, 121*, 809-817. https://dx.doi.org/10.1016/j.clinph.2009.12.013

Walker, L.A.S., Lindsay-Brown, A.P., & Berard, J.A. (2019). Cognitive fatigability interventions in neurological conditions: A systematic review. *Neurology and Therapy, 8*, 2, 251-271. https://dx.doi.org/10.1007/s40120-019-00158-3

Wilting, J., Rolfsnes, H., Zimmerman, H., Behrens, M., Fleischer, V., Zipp, F., & Gröger, A. (2016). Structural correlates for fatigue in early relapsing remitting multiple sclerosis. *European Radiology, 26*, 515-523. https://dx.doi.org/10.1007/s00330-015-3857-2

Yalachkov, Y., Soydas, D., Bergmann, J., Frisch, S., Behrens, M., Foerch, C., & Gehrig, J. (2019). Determinants of quality of life in relapsing-remitting and progressive multiple sclerosis. *Multiple Sclerosis and Related Disorders, 30*, 33-37. https://dx.doi.org/10.1016/j.msard.2019.01.049

ORIGINAL RESEARCH

Nursing and Antimicrobial Stewardship: An Unacknowledged and Underutilized Focal Point

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Abstract

Background: Nurses have the ability to play an important role in patient safety related to antibiotic use and overuse but are often not involved in antimicrobial stewardship programs (ASP). Therefore, nurses need to be educated and trained in antimicrobial stewardship (AS) so that they can more competently contribute to safe patient care. Lewin's change theory may be utilized as a framework for understanding the integration of nurses into these efforts.

Objective of the Study: This integrative review is intended to explore the role of nurses in AS and discuss the importance of nurses needing to be educated, trained, and competent in this so that they can become more actively involved in such programs.

Methodology: Articles were gathered from the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and Google Scholar from June 2015 to December 2019. A five-year time frame was implemented to ensure that the most current information was included. Seventeen peer reviewed, written in English, original research studies that met the inclusion criteria (from the original 107 studies) and conducted in Australia, Canada, Scotland, South Africa, and the United States were included in this review.

Results: The identified 17 recent studies focused on nursing and AS. Six major themes emerged, including nurses' competency requirements and training related to AS, antimicrobial knowledge and educational gaps, perceived role of the nurse, nurses' attitudes toward antimicrobial use, nurse and provider perspectives on ASPs, and nurses' valuable contributions to AS.

Discussion: This integrative review found that including nurses in AS would benefit ASPs and that finding ways for facilities to organize and implement such efforts is vital. This ties into the first stage of Lewin's change theory of "unfreezing" and recognizing that the current (or old) way of practicing is in need of change. The literature reviewed provides evidence that nurses have the capacity to be an integral part of any ASPs and that they can help combat antimicrobial resistance in myriad ways when provided the necessary training and education. All studies reviewed found positive aspects to having nurse representation. However, there are gaps in antimicrobial based knowledge on the part of the nurses.

Limitations: The limitations of this integrative review include the fact that the publications used were limited to a five-year timeframe and came specifically from nursing journals or have at least one nurse author contributor. Also, the current review included five international studies where the nurses' scope and standards of practice may be different from those in the United States. A search of the grey literature reports related to AS was not conducted and could have provided additional valuable information as well.

Conclusion and Recommendations: Nursing participation is needed in all ASPs. Empowering and educating nurses to feel confident and competent in this role will help to mitigate the overuse and misuse of antimicrobials. The ASPs most likely vary from institution to institution and future research should provide a framework for how to best disseminate information to nurses.

Keywords: Antimicrobial Stewardship, Antibiotic Training, Nurses

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Nursing and Antimicrobial Stewardship: An Unacknowledged and Underutilized Focal Point

The Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) identified the development and spread of antimicrobial resistance as a global health crisis and a major public health concern (Abbas et al., 2019; Ha et al., 2019; Manning et al., 2016; R.N. Olans et al., 2016). Due to a convergence of factors—widespread overuse, improper adherence to treatment regimens, reluctance of pharmaceutical companies to research and develop new drugs, rapid and accessible international travel, and diffusion of antimicrobial organisms—optimal conditions now exist for a "perfect storm" (R.N. Olans et al., 2016, p. 84), wherein infectious agents become resistant to all available pharmaceutical remedies. Awareness of the potential development of antimicrobial resistance was present as early as 1939 and 1945, but the lure of the "miracle drugs" overshadowed this concern (R.N. Olans et al., 2016, p. 84). It was not until 1988 that the concept and serious planning around Antimicrobial Stewardship Programs (ASPs) began (R.D. Olans et al., 2015) and it has been only since 2017 that The Joint Commission (TJC) required them. The Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS, 2012) define antimicrobial stewardship (AS) as the "coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen including dosing, duration of therapy, and route of administration" (p. 323). Hamdy et al., (2019) add that nurses are "in a unique position to fully ensure that all patient care needs are met when an antibiotic is prescribed" (p. 10) due to the fact that they are involved in most aspects of patient care and often interact with the patient more than any other health care professional. Formal stewardship teams were defined in 2001 and the key disciplines initially identified as essential to facilitate these programs in health care settings were pharmacists, microbiologists, infectious disease specialists, infection control, and attending physicians (R.D. Olans et al., 2015; R.N. Olans et al., 2016).

The one most obvious and most often overlooked professional link absent in this chain is the nurse. This is despite the fact that the nurse holds a vital role in patient care and has many clinical responsibilities related to patient safety (Cadavid et al., 2017; Hamdy et al., 2019; Jeffs et al., 2018; R.N. Olans et al., 2016).The significance of this glaring omission becomes clear when recognizing that it is the registered nurse who interfaces with the patient, the pharmacist and the ordering provider, and is responsible for the initial triage, assessing sensitivity versus allergy, and reporting progress, in both residential and in-patient settings. Moreover, it is the nurse who administers and assesses medications, acts as the patient advocate, and is, most often, the healthcare professional that patients and families see and trust the most (Cadavid et al., 2017; Carter et al., 2018; R.N. Olans et al., 2016). Educating nurses to serve as conduits between other medical personnel and the patient clearly becomes essential for any ASP to function optimally (Greendyke et al., 2018). In 2019, the CDC recognized the contribution of nurses in AS efforts by including them in their initiative to implement hospital-based antimicrobial programs (CDC, 2020). Furthermore, while the Centers for Medicare & Medicaid Services (CMS) developed regulations at the Federal level for ASPs in hospitals, nurses were not key contributors. A limited amount of research is currently available that specifically addresses the utilization of nurses as essential stakeholders in the fight against antimicrobial resistance. With the research that is currently available, the purpose of this integrative review is to explore the role of the nurse in AS and discuss the importance of nurses needing to be educated, trained, and competent in AS in order for them to become more actively involved in ASPs. Based on Lewin's theory, successful change, such as incorporating nurses into AS efforts, occurs when using a planned approach. Lewin's 3-step model of change (1951) includes: unfreezing [the current or old way of practicing is in need of change], moving to a new level [change is introduced], and refreezing [incorporating the new way] (Kelly, 2008). During "unfreezing," nurses encounter difficulties as they rethink old ways of practicing for the purposes of quality improvement. "Moving to a new level" ideas are presented to decrease inappropriate antimicrobial use, cut costs, and most importantly, improve patient outcomes. Finally, once the nurse acquires the training and knowledge base needed for active participation in ASPs, comfort and confidence help them transition in their new role ("refreezing").

Method

A search of the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and Google Scholar originally yielded 107 articles and of these, twenty-two articles were full text, peer reviewed, written in English, and original research studies published between June 2015 and December 2019. The five-year time frame was implemented to ensure that the most current information was included. Data were collected within the selected studies from September 2012 to March 2018. The studies were conducted in Australia, Canada, Scotland, South Africa, and the United States. Only articles that discussed nurse participation were included since that was the main focus of this review. Five were excluded from the final analysis because the articles were either not published in a nursing journal, did not include a registered nurse as a co-author, or did not discuss nurse participation. The search terms included (nurses OR nursing) AND (antimicrobial OR antibiotic) AND (stewardship OR education OR training). A total of nine (9) quantitative, five (5) qualitative, and three (3) mixed method studies met the inclusion criteria. Nurses working in different specialty areas (e.g., nurses working in nursing homes, infection control), with varying levels of education and roles (e.g., licensed practical nurses (LPN), registered nurses (RN), advanced practice nurses (APN) participated, but the focus of this integrative review was on the non-prescribing nurse. The authors of this paper independently read and reviewed each article several times. Each author then separately identified key themes that emerged from each article. The authors subsequently met to share their initial theme related findings and discussed associated rationales. This process allowed the authors to revise and refine

findings and ultimately reach consensus about important and reoccurring themes. At the conclusion of this process, six themes were identified.

Results

This paper identified 17 recent studies focused on nursing, AS, and ASPs. The major themes found were *nurse's competency requirements and training related to AS, knowledge and training/ educational gaps related to AS, perceived role of the nurse in AS, nurses' attitudes toward antimicrobial use, nurse and provider perspectives on ASP, and nurses valuable contributions to AS.* Table 1 lists the articles and themes identified. Many articles had more than one major theme as evidenced below.

Competency Requirements and Training Related to Antimicrobial Stewardship

Cadavid et al. (2017) found 29 of the 34 hospitals studied required bedside nurses to be competent in at least one of ten antimicrobial education topics. However, the education topics or competency requirements varied significantly among the surveyed hospitals. Although 91% (n=31) of the hospitals reported that registered nurses received microbiology laboratory results, only 47% (n=16) required competency or education related to interpreting culture and sensitivity results. Five hospitals responded that no registered nurses participated in their ASPs despite nurses' significant role in antimicrobial administration and monitoring (e.g., responsibility for assessing medication allergies before the provider puts in an antimicrobial order). The hope was that by ensuring nurse competency in several related areas (e.g., medication timing, treatment specificity of antimicrobials, and identification of broad-spectrum antimicrobials), there would be an increase in compliance to and adherence with antimicrobial stewardship activities across disciplines.

Knowledge and Training/Educational Gaps Related to Antimicrobial Stewardship

Eight articles addressed the need to strengthen nursing knowledge and encourage training related to AS so that nurses are able to contribute most effectively in ASPs. For example, Abbas et al. (2019) assessed nursing staff and found gaps in their knowledge related to AS. Specifically, results suggested that even with a majority of the participants being familiar with the term "antimicrobial stewardship," over 80% reported they have never had any AS training. Aligned with that, over 80% never communicated (or knew how to get in contact) with their hospital's ASP. Similarly, Kistler et al. (2017) examined the knowledge, attitudes, and behaviors regarding suspected infections among nurses working with older adults. A majority of participants were aware of the issues associated with "misuse and overuse" and showed attitudes and behaviors that aligned with the most recent evidence in this realm. However, results also showed that nurses needed to advance their knowledge base, as well as their attitudes and behaviors related to antibiotic overuse and misuse. Additionally, given the fact that TJC has designated nurses as "primary protectors" of patient safety, (R.N. Olans et al., 2016) focused on exploring how nurses could most effectively contribute to ASPs. Results of the study showed the need for nurses to develop a knowledge base in several areas (Table 1) before they can provide important contributions in this domain.

This review included further examination of barriers to knowledge and training. For instance, Monsees et al., (2018) evaluated the AS based knowledge and practices of pediatric nurses. The results suggested barriers existed, such as nurses not being part of medical rounds, power differentials among members of the interdisciplinary team, and nurses not being asked for their input. There is evidence that improving the knowledge base, specifically in terms of topics related to microbiology and antibiotics, along with consistently including nursing staff in the aforementioned activities, is essential. Fisher et al. (2018) also found that nurses have the ability to enhance AS activities by promoting IV to PO step-down of antimicrobials. However, nurse participants mentioned insufficient knowledge as one of the main modifiable barriers.

Training and education is key to maximizing nursing-based contributions. For example, Wilson et al. (2017) assessed nurses' knowledge and found that AS related knowledge improved after nurses participated in an educational online course offering. Nurses felt more confident contributing to the ASP in the long-term care facilities they were working in after completing the course. Empowering nurses to feel informed and important to the team can help reduce unnecessary antibiotic use in nursing homes as well. Likewise, Carter et al. (2018) underscored the fact that while nurses are in an ideal position to optimize appropriate antibiotic use, nurse participants consistently admitted knowledge gaps related to antibiotics in general. In addition to formal education and training, nurses in this sample suggested a need to have access to educational tools for reference. Finally, Greendyke et al. (2018) found that nurses generally feel that they can contribute to AS related activities. However, results also showed a need to educate nurses on the general principles of AS, so that they are able to make important contributions in this domain.

Role of the Nurse in Antimicrobial Stewardship

Six articles addressed the important role of the nurse as it relates to AS. For instance, Greendyke et al. (2018) found that nurses were generally eager to learn more about being an active member of an ASP. About one third of the participants (n = 145) felt that they could play an important role in AS by ensuring needed interventions (e.g., proper allergy histories, prioritization of antimicrobial administration, proper technique for obtaining blood cultures, and antimicrobial de-escalation) to lower inappropriate utilization of antimicrobials. On the other hand, Merrill et al. (2019) surveyed 316 nurses from three hospitals in Utah and found that about 50% of the participants did not understand their role in AS, despite recognizing that they were essential in the fight against antimicrobial resistance. Thus, education should focus on increasing nurses' knowledge on AS and how they can be utilized in the most efficient ways. About 60% of nurses in this study acknowledged the importance of antimicrobial stewardship and were enthusiastic about participation in related activities.

In an earlier study, McGregor et al. (2015) assessed knowledge of AS among 901 nurses based on the recognition that this group

of professionals is becoming more and more important in their role as administrators of antimicrobials. Specifically, the results suggested that the "role" of the nurse should include ensuring appropriate antimicrobial use (including the assurance of correct duration and prevention of overuse), a good working (and up to date) knowledge of antimicrobial guidelines, and education (e.g., educating colleagues and patients about use and challenging prescribing decisions). In a more focused setting, Rout and Brysiewicz (2017) highlighted the essential role of the intensive care unit (ICU) nurse within the AS team as vital to the success of AS in the ICU. The four categories found in the study were advocacy, organizational, clinical, and collaborative roles of the nurse. The nurse had various roles in ASPs: advocacy (reminding prescribers of antimicrobial duration for each patient), clinical (monitoring infections and progress of antimicrobial treatment), organizational, and collaborative (interaction with members of the AS team). Similarly, Hamdy et al. (2019) conducted a focus group study to assess pediatric nurses' perceptions of their role in antimicrobial stewardship. A total of five major themes were identified, including advocacy, communication, administering medications safely, and education (for both caregivers and the nurses themselves). Subthemes were also discussed within the context of each main theme (Table 1).

Additionally, Stuart et al. (2015) assessed the role of the infection control clinical nurse consultant (CNC) and found that using a CNC to drive the ASP was associated with less antibiotic use in two residential care facilities. The CNC acted as the mediator between and among infectious disease specialists, general practitioners, and nurses, in interpreting lab results and patient signs and symptoms. By so doing, significant changes in antibiotic use were found.

Nurses' Attitudes Toward Antimicrobial Use

In addition to discovering knowledge gaps related to AS, Carter et al. (2018) and Kistler et al. (2017) explored the attitudes of nurses regarding the use of antibiotic therapy. Carter et al. (2018) focused on nurse-driven antibiotic stewardship practices (Table 1) and found some of these to be perceived as an extension of the nurse's role as patient advocate. The authors also found that nurses had positive attitudes toward participating in AS and becoming more knowledgeable about their role. Kistler et al. (2018) focused on nurses working in nursing homes and found that nurse attitudes and behaviors demonstrated evidence-based knowledge, but suggested that improvement in the knowledge, attitudes, and behaviors could help decrease the overuse of antibiotic therapy.

Nurse and Provider Perspectives on ASP

Scales et al. (2016) found that both nurses and medical providers support AS and are committed to reducing unnecessary antibiotic use (but with medical providers more often than nurses). Both groups (medical providers and nurses) reported that patients and family members prefer antibiotic use and sometimes influence subsequent treatment decisions. Results also suggest that nurse leaders and medical providers working in long-term care may be particularly effective in AS efforts. Part of this is due to the fact that providers working in this subspecialty have reported an increased level of influence by patients and their families on prescribing decisions.

Valuable Contributions to Antimicrobial Stewardship

Ha et al. (2019) found that a multidisciplinary approach to AS is needed and that it is critical for nurses to be involved. As such, the bedside nurse is a valuable contributor to ASPs and any infection prevention strategies. Results suggest that there was a significant reduction in antimicrobial use when nurses were involved (791.2 vs. 697.1 days of therapy per 1,000 patient-days). Likewise, Jeffs et al. (2018) conducted focus group interviews of 11 pharmacists, 7 physicians and 6 nurses. Participants described the importance of engaging nurses in ASPs to enhance the culture of AS, to ensure easier and timely program implementation and to sustain the success of ASPs. They suggested that engaging nurses in ways that recognize their valuable contributions on ASPs is essential while more efforts are needed for nursing leadership to encourage and engage nurses in all phases of the program.

Discussion

This integrative review found that engaging nurses in AS would benefit ASPs and that finding ways for facilities to organize and implement such efforts is vital. This ties into the first stage of Lewin's change theory of "unfreezing" and recognizing that the current (or old) way of practicing is in need of change. The literature reviewed provides evidence that nurses have the capacity to be integral to any ASP and they can help combat antimicrobial resistance in myriad ways when provided the necessary training and education. All studies reviewed found positive aspects to having nurse representation in ASPs. However, based on the literature reviewed, it was also clear that there are gaps in antimicrobial based knowledge on the part of the nurse. The findings from several studies provide evidence that educated and knowledgeable nurses are willing to question prescribing providers about antibiotic management and whether or not there is a need for antibiotic use (both initial and continued use).

Staff nurses play a critical role in antimicrobial therapy in a variety of ways and stages: hospital admission, discharge, and outpatient care. The White Paper jointly issued by ANA and CDC (2017) outlined 15 areas that nurses can contribute to ASP but nurses' roles were unrecognized. They include (1) appropriate triage and isolation; (2) accurate antibiotic allergy history; (3) early and appropriate cultures; (4) timely antibiotic initiation; (5) progress reporting; (6) reviewing and communicating laboratory and radiology reports; (7) antibiotic dosing, culture and sensitivity reporting, and de-escalation; (8) monitoring and reporting adverse events; (9) reviewing patient clinical status and changes in medications; (10) tracking antibiotic resistance and patient response; (11) reporting bug/drug mismatch; (12) monitoring patient's capacity to transit from IV to PO antibiotic; (13) monitoring patient's progress 24/7; (14) educating patient and family; and (15) transition and re-admission management.

Nevertheless, the role of nursing in ASPs is only beginning to be investigated and still lacks standard protocol. R.D. Olans et al., (2015) explored how nurses could be included in the design of these programs and the elements needed to accomplish this goal.

They suggested offering an educational program that focused on six areas (see Table 1) as a good starting point and is necessary before nurses can make meaningful contributions to any ASP. Furthermore, online courses may be one way to improve nursing knowledge related to AS activities and can encourage nurses to make positive changes in their work settings, thereby improving the overall quality of care that they provide. This is aligned with Lewin's second step, "moving to a new level," where change or intervention is introduced. The benefits and disadvantages are discussed, and change is implemented (Kelly, 2008). In this phase, nurses transition to a new level by learning about AS and ASPs in order for them to feel competent in collaborating and participating in related activities.

Including nurses in ASPs was found to improve quality of care and safe practice (Cadavid et al., 2017). For example, bedside nurses are responsible for assessing allergies to medication before administration. In addition, nurses often enter verbal medication orders for antimicrobials, offering an opportunity for them to discuss indications with the prescribing provider. Findings also suggest that bedside nurses are able to recognize broad-spectrum antibiotics, interpret cultures, monitor therapeutic levels, and assess treatment for suitability when they are appropriately educated regarding AS. These functions ultimately help reduce the spread of antimicrobial resistance. Nurses play an essential role in administering and evaluating antimicrobial treatment, as well as implementing evidence-based interventions. In the third and final step of Lewin's change theory, "refreezing" occurs, where the new way of doing is incorporated into the routines or habits of affected individuals (Kelly, 2008). With the utilization of nurses on ASPs, there is the potential for increased compliance with and adherence to related activities. The 17 studies reviewed offer support for the inclusion of nurses in AS as well as insights for organizing and implementing such efforts.

The limitations of this integrative review include the fact that it was limited to a five-year timeframe yielding only 17-peer reviewed qualitative, quantitative, and mixed method studies, specifically from nursing journals or those that had at least one nurse contributor. Those that did not meet these qualifiers were excluded. The five year time frame was implemented to ensure the most current information was included. Future researchers might consider reviewing non-nursing publications over a ten year timeframe to assess for potential differences. Moreover, the articles in this review included five international studies where the scope and standards of practice may differ from those in the U.S. Also, a search of the grey literature reports related to AS was not conducted and could have provided additional valuable information. The ASPs most likely vary from institution to institution and future research should provide a framework for how to best disseminate information and education to nurses. With that, an increased level of confidence and competence is likely. Finally, additional studies that are randomized controlled trials should be conducted in order to ensure the rigor, validity, and reliability.

Conclusion

Because both the CDC and the WHO have identified the emergence and spread of antimicrobial resistance as a global health crisis and a grave threat to human health, it is imperative that nursing professionals have AS components included as requirements in their curriculum. It is also essential that all health care institutions include first-level nursing professionals in their ASP teams due to the pivotal roles' nurses play as patient advocates and educators, principal patient assessors, medication monitors and administrators, and mediators between the patient and other medical personnel. Lewin's theory of change fits well when trying to conceptualize and integrate changes in any healthcare setting, and the inclusion of nurses into ASPs is no exception. The ASP paradigm will achieve its optimal potential with nurses recognized and embraced for their important role and contribution.

Table 1
Summary of Reviewed Literature

Author/ Year/ Country	Aim	Research Type/ Sample	Theme(s) in this review[a]	Key Findings	Limitations
Abbas et al. (2019) United States	To ascertain the attitudes, knowledge, practice, and barriers related to the participation of nurses in antimicrobial stewardship (AS) and antimicrobial stewardship programs (ASP)	Quantitative cross-sectional study/ n=159 nursing staff members from an 850-bed tertiary care academic center in Richmond, VA that had a well-organized ASP for 2 decades	Theme 2	• 120 nurses were unaware of the ASP at the facility • 102 participants indicated familiarity with AS along with concerns over physician pushback and time constraints related to participants • 31 nurses stated they had formal training on AS • Gaps in knowledge were discovered in the area of AS and the communication between nurses and ASPs	• Only one facility that had a well-resourced ASP in place for two decades was included in the study • The survey was distributed via a list serve that went out to 3,485 nurses made it difficult to determine the exact number of active nursing staff reached • Demographic information for the participants was not obtained
Cadavid et al. (2017) United States	To evaluate the antimicrobial related training and education provided to bedside RNs in acute-care hospitals in Los Angeles County	Quantitative, online survey/n=34 nurse educators from 34 hospitals	Theme 1	• In 97%) of the hospitals, nurses are responsible for assessing medication allergies prior to the provider placing the antimicrobial order • In 91.1% of the hospitals, nurses are offered training on or are required to understand the correlation between the use and resistance of antimicrobials	Rate of response was low (37%/n=34)

Carter et al. (2018) United States	To explore the attitudes of nurses and infection preventionists (IPs) toward the nurse-driven antibiotic stewardship activities of: 1) questioning the medical necessity of urine cultures; 2) ensuring proper urine and blood culturing techniques; 3) initiating the switch from IV to PO antibiotics; 4) obtaining and recording an accurate penicillin drug allergy history; and 5) initiating an antibiotic timeout) recommended by the American Nurses Association (ANA)/CDC working group	Qualitative, focus groups and semi-structured interviews/n=49 convenience sampling, clinical nurses, 5 nurse managers, and 7 IPs in 2 hospitals	Themes 2 and 4	While participants were excited about contributing to antibiotic stewardship efforts, they describe several barriers that challenge the activities recommended by the ANA/CDC including (1) unaddressed knowledge needs; (2) discomfort in questioning prescribers orders; (3) lack of ongoing formal education in culturing techniques; (4) lack of accountability regarding proper techniques; (5) lack of awareness of negative consequences that result from poor culturing techniques; (6) family push-back; (7) outside the nurses' scope of practice; (8) knowledge needs and gaps; (9) prescriber push-back; (10) patient-level considerations; and (11) lack of perceived value to nurse-initiated antibiotic time-outs as antibiotics are already closely monitored by prescribers and Pharm D. Questioning the need for urinary cultures, obtaining cultures using proper collection techniques, and initiating the switch from IV to PO antibiotics were the three recommendations viewed as most favorably by this sample. Ensuring an accurate penicillin drug allergy history and initiating an antibiotic timeout were two other recommendations met with resistance because they were perceived to exceed a nurse's scope of practice.	Generalizability issues due to the study being conducted at two academic teaching hospitals in NYC.

Fisher et al. (2018) Canada	To assess the barriers and facilitators of nurse's knowledge, role, and behavior regarding AS and the promotion of intravenous (IV) to oral (PO) antimicrobials by nurses	Qualitative, prospective, descriptive study/ n=15 bedside nurses (RNs and LPNs) working on a medical or surgical unit in 3 different environments (general medicine and stroke care unit; a general and vascular surgery unit; and an oncology general medicine unit) in a 400-bed tertiary referral hospital	Theme 2	• 9 themes identified as barriers that included insufficient knowledge, lack of prescriber cooperation, step down viewed as role of the prescriber, and lack of self-confidence • 9 themes identified as facilitators that included capability of actively participating in team rounds, confidence in ability to promote IV to PO step down with support of colleagues and other health care professionals • Nurses also realized that an increase in the step down IV to PO rates would increase nursing efficiency	• One tertiary hospital used • Small sample size (n=15) • Interviews were used instead of focus groups where more possible barriers and facilitators may have been revealed
Greendyke et al. (2018) United States	To explore the knowledge, attitudes, practice, and role of the bedside nurse in antimicrobial stewardship	Quantitative, descriptive study/ Five acute-care hospitals participated n=451 nurses	Themes 2 and 3	The need to educate nurses on antimicrobial stewardship was found especially in areas of allergy histories, blood culture techniques, antimicrobial de-escalation, and prioritizing antimicrobial administration. With the large number of practicing nurses this could make for a significant decline in inappropriate antimicrobial use.	Relatively low response rate, the respondents may not be generalized among all nurses
Ha et al. (2019) United States	To investigate the need for multidisciplinary approaches to ASP to include bedside nurse involvement	Quantitative, retrospective evaluation/n=an evaluation of AS rounds conducted on a 31-bed medical telemetry step-down unit in a 417-bed community regional medical center	Theme 6	Significant reductions in unit antimicrobial use was found when compared with the 12-month preintervention period (791.2 vs. 697.1 therapy days per 1000 patient-days; p=0.03), acid suppressant medication use (708.1 vs.372.4 days of therapy per 1000 patient-days; p=0.0001), and urinary catheter use (0.3 vs. 0.2 catheter-days per patient-day; p=0.002)	• Antimicrobial resistance was not assessed due to a short one-year study and were not able to • Assess longer-term effects • No control group was used • Only one hospital telemetry unit was included in the study • The intervention was performed twice a week

Hamdy et al. (2019) United States	To explore perceptions of pediatric nurse's role in AS	Qualitative, focus groups/n=90 nurses involved in 12 focus group study sessions on 10 different clinical units at a freestanding children's hospital	Theme 3	Nurses perceived their important role in AS and found they should play a major role in AS desiring additional education for advocating for their patients and communicating with the team. Barriers included inconsistent inclusion of nurses on rounds and lack of institutional protocols for antibiotics	Pediatric nurses from one facility
Jeffs et al. (2018) Canada	To identify strategies to enhance nurses' engagement in ASPs and optimize antimicrobial use	Qualitative, focus groups/ n=25 individuals participating in 6 focus groups (pharmacists (n = 11), physicians, (n = 7), and nurses (n = 6) who were in management roles, and one unidentified)	Theme 6	Three key themes emerged in this study including (1) leveraging the interest and passion of nurses; (2) making it routine practice; and (3) engaging nurses to sustain and spread ASP by nurse leaders	• The study included nurses who were part of the ASP team and not those who were recipients of local specific projects. • Social desirability given the self-report nature of the study • Because the 4 ICUs included in the study were in close proximity, generalizability to other settings may be limited.
Kistler et al. (2017) United States	To examine the knowledge, attitudes, and behaviors of suspected infections among nurses working in nursing homes and community-dwelling older adults	Mixed method, exploratory design with convenience samples/n=32 nurses working in nursing homes and n=66 community dwelling older adults (≥ 65 years old)	Themes 1 and 4	• Almost all nurses (94%) disagreed or strongly disagreed with the statement "When I have cold, I should take antibiotics to prevent getting a more serious illness" (p. 5), as compared to older adults (77%; p<.01) • Qualitative analysis identified six themes, four of which were found among nurses and older adults • The four common themes included further observation, further work-up, provider evaluation, and non-pharmacologic management The theme unique to nurses was following the protocol, while uncertainty was distinct to older adults.	Select population and sample size limits generalizability

McGregor et al. (2015) Scotland	To assess knowledge of antimicrobial stewardship among nurses given the increasingly important role they play in the administration of antimicrobials	Quantitative, descriptive survey design/ n=901 nurses and midwives (n=855 completed an online survey and n=46 completed questions face-to-face)	Theme 3	• 36.1% of the participants rated their knowledge of antibiotics as “good” or “very good" while only • 21.5% had heard of the term “antimicrobial stewardship" • 74.4% indicated that education on antimicrobial stewardship should begin while obtaining the degree, with a preferred format as a blend of styles (54.4%) • 36.8% thought that the nurse/midwife role should involve ensuring appropriate antimicrobial use and the common challenge to incorporating antimicrobial stewardship-based practices was time constraints/workload (26.3%) • The most cited type of ongoing support needed to take on the antimicrobial stewardship role was support from various sources such as colleagues/management/ clinicians (42.0%)	Low response rate (901 out of 67,400
Merrill et al. (2019) United States	To evaluate nursing knowledge related to antimicrobial stewardship and their role in contributing to antimicrobial endeavors	Quantitative, descriptive survey design/n=316 convenience sample nurses from 3 hospitals in an integrated health system in Utah.	Theme 3	• 52% were not familiar with AS • 39.6% felt and AS program was important, • 95% felt that they should be involved in AS interventions	• The study only included inpatient nurses from 3 hospitals within the same health care system • The questions on the survey may not have been geared toward nursing practice

Monsees et al. (2018) United States	To identify the nurse's confidence in engaging in (AS) practices within the pediatric population	Quantitative, single-centered, cross-sectional survey study/n=180 pediatric in-patient staff nurses working at a 354 bed children's hospital	Theme 2	• Nurses were confident assessing the history of adverse drug reactions, patient education, and obtaining cultures, but less confident understanding lab results to determine antibiotic appropriateness. • Nurses were not consistently included in AS rounds and nursing input was not actively sought.	• Only one hospital (pediatric, with infectious disease physicians and established stewardship team) were involved in study • The survey used lacked formal testing for reliability and validity
Olans, Nicholas et al, (2015) United States	To examine how nurses could be included in ASPs and what would be needed to accomplish this	Mixed methods, with two serial surveys, using Delphi process/ n=10 nurse educators working in a variety of specialties from 180-bed, 2-campus community hospital with an established ASP	Theme 2	Results showed six areas necessary for nurses to have knowledge in before they can make meaningful contributions to any ASP including: 1. Skills in recognizing early signs of infection 2. Being able to differentiate between an infection and organism colonization 3. Understanding how to interpret microbiology lab results and how an antibiogram should be used when choosing antibiotics 4. Knowledge about obtaining good culture samples as well as how well the laboratory processes them 5. Knowing when and which antibiotics can be switched for oral ones and when and how broad-spectrum antibiotics should be moderated to narrower spectrum ones 6. Increased confidence in asking prescriber questions about antimicrobials	Small sample size
Rout & Brysiewicz (2017) South Africa	To explore the role and the necessary skills of the nurse on an ASP	Qualitative, semi-structured interviews/n=15 purposive sampling, individuals (9 nurses and 8 non-nurses from disciplines including medicine, pharm, & microbiology)	Theme 3	Content analysis yielded four themes including the organizational role, the advocacy role, the clinical role and the collaborative role	The findings are contextual, specific to the hospital focused on in the study

Scales et al. (2016) United States	To assess perspectives on antibiotic use and stewardship among nurses and providers	Mixed method, cross-sectional survey/n=182 nursing staff (directors of nursing, infection control nurses, RNs, LPNs); and n=50 medical providers	Theme 5	Nurses are more ready overall than medical providers to implement change regarding the reduction of antibiotic use (3.6 +/- 0.8 and 2.9 +/- 0.9, respectively; P< .001)	The sample size and region limited the generalizability of this study
Stuart et al. (2015) Australia	To evaluate the role of infection control clinical nurse consultants on the ASP	Quantitative, pre-during-post intervention pilot study/n=2 residential aged care facilities (with a total of 130 beds)	Theme 3	Results showed that 102 antimicrobials were ordered and given at baseline and 83 after the completion of the intervention, yielding a significant reduction in the total number of antimicrobials prescribed in a given number of days (P<.0001)	Select population and sample size limits generalizability
Wilson et al. (2017) United States	To assess nurses' awareness of their function in antimicrobials stewardship in a long-term care setting	Quantitative, paired pre- and post-course survey/n=103 nurses (71 RNs and 32 LPNs) working at a community-based nursing home	Theme 2	Post intervention results showed a statistically significant improvement in the number of knowledge-based questions answered correctly (75%-86%: P<.001)	• A relatively small sample size with 50% attrition rate • Potential of social desirability bias • Lack of differentiation between educational backgrounds and professional roles • Some survey items were not validated

Note: [a.] Theme 1=nurses' competency requirement and training related to antimicrobial stewardship: Theme 2=antimicrobial knowledge and training/educational gaps, Theme 3=role of the nurse; Theme 4= nurses' attitudes toward antimicrobial use; Theme 5=nurse and provider perspectives on ASP; and Theme 6=nurses' valuable contributions to antimicrobial stewardship.

References

Abbas, S., Lee, K., Pakyz, A., Markley, D., Cooper, K., Vanhoozer, G., Doll, M., Bearman, S., & Stevens, M. P. (2019). Knowledge, attitudes, and practices of bedside nursing staff regarding antibiotic stewardship: A cross-sectional study. *American Journal of Infection Control, 47*(3), 230-233. https://dx.doi.org/10.1016/j.ajic.2018.09.008

American Nurses Association & Centers for Disease Control and Prevention (2017). *Redefining the antibiotic stewardship team: Recommendations from the American Nurses Association/ Centers for Disease Control and Prevention workgroup on the role of registered nurses in hospital antibiotic stewardship practices.* Silver Spring, MD: American Nurse Association. https://www.cdc.gov/antibiotic-use/healthcare/pdfs/ANA-CDC-whitepaper.pdf

Cadavid, C. C., Sakamoto, S. D., Terashita, D. M., & Schwartz, B. (2017). Bedside registered nurse roles in antimicrobial stewardship: A survey of acute-care hospitals in Los Angeles County. *Infection Control & Hospital Epidemiology, 38*(10), 1263-1265. https://dx.doi.org/10.1017/ice.2017.166

Carter, E. J., Greendyke, W. G., Furuya, E. Y., Srinivasan, A., Shelley, A. N., Bothra, A., Saiman, L., & Larson, E. L. (2018). Exploring the nurses' role in antibiotic stewardship: A multisite qualitative study of nurses and infection preventionists. *American Journal of Infection Control, 46*(5), 492-497. https://dx.doi.org/10.1016/j.ajic.2017.12.016

Centers for Disease Control and Prevention. (2019). *Core elements of hospital antibiotic stewardship programs.* https://www.cdc.gov/antibiotic-use/core-elements/hospital.html

Fisher, C. C., Cox, V. C., Gorman, S. K., Lesko, N., Holdsworth, K., Delany, N., & McKenna, C. (2018). A theory-informed assessment of the barriers and facilitators to nurse-driven antimicrobial stewardship. *American Journal of Infection Control, 46*(12), 1365-1369. https://dx.doi.org/10.1016/j.ajic.2018.05.020

Gillespie, E., Rodrigues, A., Wright, L., Williams, N., & Stuart, R. L. (2013). Improving antibiotic stewardship by involving nurses. *American Journal of Infection Control, 41*(4), 365-370. https://dx.doi.org/10.1016/j.ajic.2012.04.336

Greendyke, W. G., Carter, E. J., Salsgiver, E., Bernstein, D., Simon, M. S., Saiman, L., Calfee, D., & Furuya, E. Y. (2018). Exploring the role of the bedside nurse in antimicrobial stewardship: Survey results from five acute-care hospitals. *Infection Control & Hospital Epidemiology, 39*(3), 360-362. https://dx.doi.org/10.1017/ice.2017.255

Ha, D. R., Forte, M. B., Olans, R. D., O'Yong, K., Olans, R. N., Gluckstein, D. P., Kullar, R.,Desai, M., Catipon, N., Ancheta, V., Lira, D., Khattak, Y., Legge, J., Nguyen, K. B.,Chan, S., Mourani, J., & McKinnell, J. A. (2019). A multidisciplinary approach to incorporate bedside nurses into antimicrobial stewardship and infection prevention. *Joint Commission Journal on Quality and Patient Safety, 45*(9), 600-605. https://dx.doi.org/10.1016/j.jcjq.2019.03.003

Hamdy, R., Neal, W., Nicholson, L., Ansusinha, E., & King, S. (2019). Pediatric nurses' perceptions of their role in antimicrobial stewardship: A focus group study. *Journal of Pediatric Nursing, 48*(1), 10-17. https://dx.doi.org/10.1016/j.pedn.2019.05.020

Jeffs, L., Law, M. P., Zahradnik, M., Steinberg, M., Maione, M., Jorgoni, L., Bell, C.M., & Morris, A. M. (2018). Engaging nurses in optimizing antimicrobial use in ICUs: A qualitative study. *Journal of Nursing Care Quality, 33*(2), 173-179. https://dx.doi.org/10.1097/NCQ.0000000000000281

Kelly, P. (2008). *Nursing leadership & Management*. Delmar Cengage Learning.

Kistler, C. E., Beeber, A., Becker-Dreps, S., Ward, K., Meade, M., Ross, B., & Sloane, P. D. (2017). Nursing home nurses' and community-dwelling older adults' reported knowledge, attitudes, and behavior toward antibiotic use. *BMC Nursing, 16*(12), 1-7. https://dx.doi.org/10.1186/s12912-017-0203-9

Manning, M. L., Pfeiffer, J., & Larson, E. L. (2016). Combating antibiotic resistance: The role ofnursing in antibiotic stewardship. *American Journal of Infection Control, 44*(12), 1454-1457. https://dx.doi.org/10.1016/j.ajic.2016.06.023

McGregor, W., Brailey, A., Walker, G., Bayne, G., Sneddon, J., & McEwen, J. (2015).Assessing knowledge of antimicrobial stewardship. *Nursing Times, 111*(21), 15-17.

Merrill, K., Hanson, S. F., Sumner, S., Vento, T., Veillette, J., & Webb, B. (2019). Antimicrobial stewardship: Staff nurse knowledge and attitudes. *American Journal of Infection Control, 47*(10), 1219-1224. https://dx.doi.org/10.1016/j.ajic.2019.03.022

Monsees, E., Popejoy, L., Jackson, M. A., Lee, B., & Goldman, J. (2018). Integrating staff nurses in antibiotic stewardship: Opportunities and barriers. *American Journal of Infection Control, 46*(7), 737-742. https://dx.doi.org/10.1016/j.ajic.2018.03.028

Olans, R. D., Nicholas, P. K., Hanley, D., & DeMaria, A. (2015). Defining a role for nursing education in staff nurse participation in antimicrobial stewardship. *Journal of Continuing Education in Nursing, 46*(7), 318-321. https://dx.doi.org/10.3928/00220124-20150619-03

Olans, R. N., Olans, R. D., & DeMaria, A. (2016). The critical role of the staff nurse in antimicrobial stewardship. Unrecognized, but already there. *Clinical Infectious Diseases, 62*(1), 84-89. https://dx.doi.org/10.1093/cid/civ697

Rout, J. & Brysiewicz, P. (2017). Exploring the role of the ICU nurse in the antimicrobial stewardship team at a private hospital in KwaZulu-Natal, South Africa. *Southern African Journal of Critical Care, 33*(2), 46-50. https://dx.doi.org/10.7196/SAJCC.2017.v33i2.331

Scales, K., Zimmerman, S., Reed, D., Beeber, A. S., Kistler, C. E., Preisser, J. S., Weiner, B.J., Ward, K., Fann, A., & Sloane, P. D. (2016). Nurse and medical provider perspectives on antibiotic stewardship in nursing homes. *Journal of the American Geriatrics Society, 65*(1), 165–171. https://dx.doi.org/10.1111/jgs.14504

Society for Healthcare Epidemiology of America, Infectious Diseases Society of America & Pediatric Infectious Diseases Society (2012). Policy statement on antimicrobial stewardship by the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS). *Infection Control and Hospital Epidemiology, 33*(4), 322-327. https://dx.doi.org/10.1086/665010

Stuart, R. L., Orr, E., Kotsanas, D., & Gillespie, E. E. (2015). A nurse-led antimicrobial stewardship intervention in two residential aged care facilities. *Healthcare Infection, 20*(1), 4-6. http://dx.doi.org/10.1071/HI14016

Wilson, B. M., Shick, S., Carter, R. R., Heath, B., Higgins, P. A., Sychla, B., Olds, D.M., & Jump,R. L. P. (2017). An online course improves nurses' awareness of their role as antimicrobial stewards in nursing homes. *American Journal of Infection Control, 45*(5), 466-470. https://dx.doi.org/10.1016/j.ajic.2017.01.002

ORIGINAL RESEARCH

Quality and Safety Competencies in Undergraduate Nursing Education: Where are we now?

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Abstract

BACKGROUND: Medical errors are the third leading cause of death in the United States. To address this problem, a concerted effort by nurse educators to integrate Quality and Safety Education for Nurses (QSEN) competencies into nursing curricula is relevant. There is a need for innovative educational strategies, faculty development, and implementation approaches to support successful QSEN competency implementation.

PURPOSE: The purpose of this research was to evaluate a faculty development course that included QSEN competency education, resources, and support.

METHODS: A pretest posttest design was used and 19 nursing faculty from a northeast U.S. public college participated in the program. Participants completed the National QSEN Faculty Survey before and after a 6-part QSEN competency-based training course. Descriptive statistics and the chi-square statistical test were used to compare means of pretest and post-test responses.

RESULTS: Results indicated a significant increase of incorporating the QSEN competencies in nursing courses following the faculty development program. The most helpful QSEN resource was found to be the QSEN website followed by the Institute for Healthcare Improvement (IHI) in pre and post-test results. Case studies, lectures, and group projects were the most frequently used teaching strategies, and the classroom was found to be the setting where most faculty integrated QSEN competencies into their courses.

IMPLICATIONS: Faculty development programs are an effective method of providing support for the integration of QSEN competencies into the undergraduate nursing curricula. Evaluation of faculty development programs is essential so that effective programs can be shared and sustained.

Keywords: QSEN, competencies, faculty development, quality, safety

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Quality and Safety Competencies in Undergraduate Nursing Education: Where are we now?

The pace and scale of improvement in patient safety has been slow and limited. The reality is that medical errors are the third leading cause of death in the United States (Makary & Daniel, 2016). Dating back to the Institute of Medicine's (now the National Academy of Medicine) 2001 report, data indicate a steady increase in the number of lives lost each year to preventable errors. Recognizing the need to improve patient outcomes, the Quality and Safety for Nurses (QSEN) initiative was developed to address the challenge of preparing future nurses with the knowledge, skills, and attitudes (KSAs) necessary to continuously improve the quality and safety of the healthcare systems within which they work (Sullivan, Hirst & Cronenwett, 2009). Early QSEN research focused on the development of six competencies: safety, teamwork and collaboration, informatics, quality improvement, evidence-based practice, and patient centered care that were considered an essential part of nursing curricula, faculty development, and nursing education. As a result, nursing programs across the U.S. began integrating quality and safety content throughout their curricula. Despite efforts by nurse educators, students did not perceive that this content was integrated throughout their nursing program (Peterson-Graziose & Bryer, 2017). In addition, nurse educators felt unprepared to teach quality and safety content in a way that reflected current evidence-based practice. Research indicates the need for educational strategies, faculty development and support to facilitate meaningful integration of the QSEN competencies across nursing curricula (Altmiller & Armstrong, 2017).

Literature Review

Research suggests inconsistencies in the number of faculty trained and differences in preparation to teach QSEN competencies among nurse educators. In a study by Disch, Barnsteiner, and McGuinn (2013), an evaluation of the QSEN impact on curricula in six nursing schools found varying degrees of implementation of the six competencies. Two major factors associated with the degree of implementation were the stability and support of leadership and access to resources. Lewis and Lamb (2011) found that increasing faculty knowledge and skills, and faculty willingness to learn are vital to the integration of QSEN competencies into nursing curricula. In a later study of 252 DNP programs in the United States, 117 faculty indicated that they were skilled, but not proficient in quality improvement strategies. In addition, qualitative results found that DNP faculty found the need for quality improvement and QSEN refresher programs (Tovar et al., 2019).

A study of over 1,100 nursing faculty examined the diffusion of QSEN competencies across schools of nursing (Barnsteiner et al., 2012). Results indicated differences in the level of integration based on the competency. Quality improvement and informatics had lower levels of integration than evidence-based practice, teamwork and collaboration, safety, and patient-centered care (Barnsteiner et al., 2012). A systematic review of the literature by Cengiz and Yoda (2020) revealed that students feel more prepared to perform patient centered care skills and least prepared to perform quality improvement.

Limited resources, lack of knowledge about the competency and unfamiliarity with core measures were cited by faculty as reasons for limited integration of the two competencies. An assessment of quality and safety education in nursing (Pollard et al., 2014) found that faculty rated themselves as either expert or having some comfort in teaching the QSEN competencies. However, they were least comfortable teaching quality improvement and informatics. All study participants agreed that they wanted more information and education in the areas of evidence-based practice and quality improvement. The 2017 National QSEN Faculty Survey was used to examine faculty needs related to the integration of QSEN in nursing curricula (Altmiller & Sullivan, 2017). Results reflect that the QSEN competencies were integrated to some degree by nurse educators, but this varied greatly among nursing programs. The highest level of integration was found in fundamentals and medical-surgical courses, and the lowest level was found in nursing research courses (Altmiller & Sullivan, 2017).

Altmiller and Sullivan (2017) noted that similar to previous studies (Barnsteiner et al., 2012; Peterson-Graziose & Bryer, 2017), the competencies of safety, teamwork and collaboration, patient-centered care, and evidence-based practice were incorporated more often in nursing courses than informatics and quality improvement. Additionally, it is unclear if faculty are teaching updated QSEN competencies in their current curricula. The study found inconsistencies in the number of faculty trained in QSEN competencies, ranging from fully prepared to minimally-prepared. Barriers to integration of the competencies included lack of understanding, lack of time to learn about QSEN, and lack of resources. The need for teaching strategies to infuse quality and safety concepts into nursing curricula was an essential finding of this study.

The purpose of this research was to provide education, resources and support to nursing faculty in order for them to gain understanding and increase incorporation of the QSEN competencies in their nursing courses, and to determine the extent to which nursing faculty integrate QSEN competencies into the nursing curriculum. Inconsistencies among the number of faculty trained and differences in preparation demonstrate the need for organized, focused educational programs.

Method

A pretest-posttest design was used to measure faculty perceptions of the extent to which they teach the knowledge, skills, and attitudes associated with QSEN competencies in their nursing courses. Fulltime faculty were recruited during a monthly staff meeting. The time frame for this study was between fall 2018 and fall 2019. A non-probability convenience sample was used with no exclusions in gender, age, or ethnic background. Participants were asked to complete the National QSEN Faculty Survey before attending the first workshop, and again, one month after completing the six-part QSEN competency-based training course. The training course consisted of an electronic slide

presentation, active learning strategies, references, and resources including the QSEN website. Descriptive statistics of frequency, range, mean, and median were used to analyze the demographic data. Pearson Chi-square was used to determine if there was any statistical significance to the distribution of responses for each of the QSEN competencies between the pretest and posttest groups. IRB approval was obtained and all subjects consented to participate in the study (approval code SKM_364e180914).

Instrument

The National QSEN Faculty Survey is a 19-item instrument with three items focused on demographics and the remainder measuring the integration of QSEN competencies into the respondent's nursing program. Additional aims of the survey include measuring the degree of faculty development in schools where QSEN is being used, and assessment of whether QSEN competencies are being taught in schools of nursing. The majority of questions were "select all that apply" format with two additional open-ended questions. The original 16-item survey was reviewed by a panel of experts for clarity and edits, tested in a small sample of nurse educators, and resulted in the 19-item instrument.

Results

A total of 19 faculty members, all female, participated in this study. Fifty percent of the participants reported less than 10 years teaching experience and 27% reporting teaching less than 5 years. The majority of faculty (79%) reported teaching primarily in a prelicensure baccalaureate program. The remainder of the participants reported teaching primarily in a RN-BS program.

Integration of QSEN Competencies

Data were examined using Pearson Chi-Square to determine if there were any statistically significant differences between the distribution of responses for the pretest and posttest groups. While there were no statistically significant associations for integration of each of the competencies into the curriculum, most competencies showed an increase in integration. Pretest results reveal 90% of participants reported teaching patient-centered care, 84 % evidence-based practice, 84% teamwork and collaboration and 89% safety in their courses. The competencies of quality improvement and informatics were reported to be the least integrated into the curriculum at 63% and 33% respectively. Posttest results show 100% of participants report teaching patient-centered care, and evidence-based practice, 93% teamwork and collaboration and safety, and 73% quality improvement in their courses. The competency of informatics indicated slightly more integration in the pretest group (Figure 1). This may be due to a knowledge deficit related the meaning of the informatics competency.

Figure 1

QSEN Competencies Covered in Pre Versus Post Group

Barriers to Faculty Learning

One hundred percent of faculty reported that support from administration to learn the QSEN competencies was not a barrier to faculty learning. However, there were some other barriers to faculty learning identified. Pretest results showed almost half of the faculty-participants reported needing ideas for QSEN integration, and about one third reported challenges in getting colleagues to participate in integration. In response to an open-ended question about what would be helpful to successfully implement QSEN competencies into their nursing program, participants stated that ongoing continuing education programs or biannual workshops would be beneficial. Posttest results revealed a statistically significant change from pretest results in the response to "needing ideas for QSEN integration" ($X^2 = 4.437$, $p < 0.05$). The 'need ideas for integration' is a less frequent barrier in the post group. Interestingly, "getting colleagues to participate in integration" of the competencies was perceived as more of a barrier after the workshop, with a 10% increase from pretest to posttest.

Faculty Training

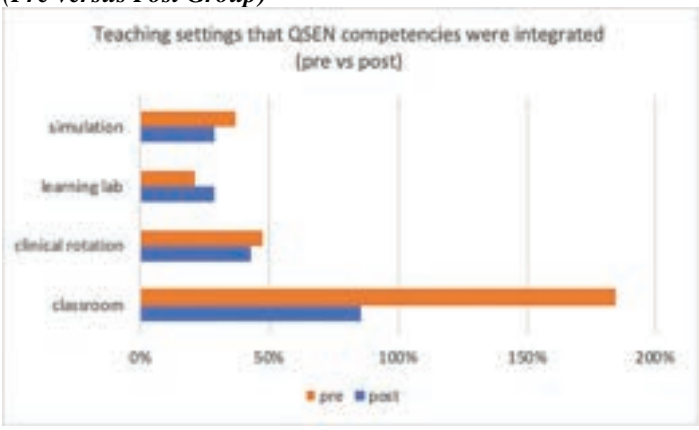
At pretest, only 32% of faculty reported being trained in QSEN competencies. Posttest results revealed a statistically significant increase in the number of faculty who reported having received training (90%) ($X^2=12.616$, $p <0.05$). Helpfulness of resources to assist with the integration of QSEN competencies into the curriculum was explored. Results revealed that the distribution of responses differed in a statistically significant way between pretest and posttest responses for the 'QSEN website' resource ($X^2=8.259$, $p<0.05$), the 'QSEN video presentations' ($X^2=7.174$, $p<0.05$), and the 'QSEN learning modules' resource ($X^2=3.849$, $p<0.05$). The increase in faculty response to the helpfulness of these resources between pretest and posttest is likely due to the training that the participants received during the faculty workshops highlighting the QSEN resources available to them.

Teaching Setting

Analysis was conducted to determine if there were any statistically significant differences to the distribution of the setting where QSEN competencies were taught between the pretest and posttest groups. Although the Pearson Chi-Square statistical test indicated that the distribution of responses did not differ

significantly, 16 of the 19 faculty-participants reported teaching the competencies in the classroom during the pretest. Posttest results revealed a shift in the teaching setting, as faculty now reported an increase in lab teaching (21.1% pretest/28.6% posttest) and a decrease in classroom teaching (n=16 pretest/n=12 posttest). This may reflect an increased awareness or change in perspective of the QSEN competencies and the related knowledge, skills, and attitudes (Figure 2).

Figure 2
Teaching Settings that QSEN Competencies were Integrated (Pre Versus Post Group)



Teaching Strategies

A statistical analysis was conducted to determine whether responses for the effectiveness of the teaching strategy between the pretest and the posttest groups was significant. Using Pearson Chi-Square, findings indicated that the distribution of responses only differ in a statistically significant way across the pretest and posttest group for the 'case studies' teaching strategy, but only at the 90% level of significance (X^2=3.342, p<0.1). Case studies were reported as a more effective teaching strategy among the posttest group (57.9% pretest/86.7% posttest). This may be a result of faculty exposure to the case study strategy during the QSEN workshops.

Finally, analysis was conducted to determine if there was a statistically significant association between QSEN integration and the number of years in teaching. Using Pearson r, results indicated a positive correlation between the number of course content areas with QSEN competencies integrated and the number of years in teaching (r=.435, p<0.05). The greater the number of years of faculty teaching experience, the higher the number of course and content areas integrated.

Discussion

This research describes how full time faculty members teaching in a baccalaureate nursing program in the northeastern United States were surveyed to ascertain their perceptions of the integration of QSEN competencies in their nursing courses. Faculty were invited to participate in a six-part QSEN competency-based training workshop and complete the survey again. The majority of faculty reported integrating the QSEN competencies of patient-centered care, evidence-based practice, teamwork and collaboration and safety into their courses. The competencies of quality improvement and informatics were reported to be the least integrated. These results are congruent with findings from the literature (Altmiller & Armstrong, 2017; Bryer & Peterson-Graziose, 2014). Barriers to integrating the QSEN competencies identified by nursing faculty include needing ideas for QSEN integration and getting colleagues to participate in integration. In fact, 100% of faculty reported strong administrative support to learn and integrate QSEN. Targeted educational programs emphasizing the informatics and quality improvement competencies may provide the necessary resources and support for faculty to gain understanding to increase incorporation of the competencies in their nursing courses. Surprisingly, only one third of the faculty reported being trained in QSEN competencies prior to attending the six-part QSEN competency-based training offered in this study. This highlights the need for ongoing, organized educational programs, and identification of resources for faculty to aid in the integration of QSEN competencies in nursing curricula. The open-ended responses underscored the need for supporting nursing faculty to effectively teach the QSEN competencies. Findings related to teaching strategies, specifically the increased use of case studies, may be reflective of faculty gaining a deeper understanding of the benefits of innovative, student-centered learning after attending the workshop. Additionally, faculty reported increased knowledge of the QSEN website resource, QSEN video presentations, and the QSEN learning modules resources after completing the training. Sustaining nursing faculty education in the QSEN initiative is of vital importance.

Prior to the QSEN workshops, findings indicated that the majority of faculty taught the QSEN competencies in the classroom setting. Broadening the faculty perspective on the variety of settings where the competencies can be integrated resulted in a decrease in classroom integration and an increase in learning lab integration. Introduction of possibilities for integration in less commonly used educational settings may foster faculty innovations and creativity in delivering quality and safety concepts. Interestingly, nurse educators with more years of experience were found to have more course and content area integration of QSEN competencies than faculty with fewer years of teaching experience. This may be a result of increased confidence in their teaching ability and their willingness to embrace current, evidence-based practice. Workshops led by experienced faculty may help overcome the barrier of getting colleagues to participate in integration. Shared ideas and experiences may provide support for newer faculty to expand integration of QSEN competencies in their own courses.

Limitations

There are several limitations to this study that must be considered. This study was conducted at one suburban college in the northeastern United States and the sample size was small. This may not be representative of all nursing faculty. There were four faculty who completed the pretest but did not complete the posttest which potentially could have impacted the results.

Summary

There has been a concerted effort by nurse educators to integrate QSEN competencies into nursing curricula. Considering the findings in this study, the need for ongoing faculty development is evident. Many educators feel unprepared to teach quality and safety content in a way that reflects current practice, particularly the competencies of quality improvement and informatics. It is essential to provide faculty with continuing education, ideas for teaching strategies, and resources for meaningful and sustained integration of QSEN competencies in nursing curricula.

References

Altmiller, G., & Armstrong, G. (2017). 2017 national quality and safety education for nurses faculty survey results. *Nurse Educator, 42*(58), 3-7. https://dx.doi.org/10.1097/NNE.0000000000000408

Barnsteiner, J., Disch, J., Johnson, J., McGuinn, k., Chappell, K., & Swartwout, E. (2012). Diffusing QSEN competencies across schools of nursing: The AACN/RWJF faculty development institutes. *Journal of Professional Nursing, 29*(2), 68-74. https://dx.doi.org/10.1016/j.profnurs.2012.12.003

Bryer, J., & Peterson-Graziose, V. (2014). Integration of quality and safety competencies in undergraduate nursing education: A faculty development approach. *Teaching and Learning in Nursing, 9*(3), 130-133. https://dx.doi.org/10.1016/j.teln.2014.04.004

Cengiz, A., & Yoda, L. (2020). Assessing nursing students' perceptions of the QSEN competencies: A systematic review of the literature with implications for academic programs. *World Views on Evidence Based Nursing: Linking Evidence to Action, 17*(4), 275-282. https://doi.org/10.1111/wvn.12458

Disch, J., Barnsteiner, J., & McGuinn, K. (2013). Taking a "deep dive" on integrating QSEN content in San Francisco Bay area schools of nursing. *Journal of Professional Nursing, 9* (2), 75-81. https://dx.doi.org/10.1016/j.profnurs.2012.12.007

Institute of Medicine (2001). *Crossing the quality chasm: A new health system for the 21st century.* National Academy Press

Lewis, M., & Lamb, G. (2011). A comprehensive model for teaching Quality and Safety Education for Nurses (QSEN) competencies. *Dean's Notes, 3*(5), 1-3.

Makary, M. A., & Daniel, M. (2016). Medical error-the third leading cause of death in the US. *BMJ (Online), 353*, [i2139]. https://dx.doi.org/10.1136/bmj.i2139

Peterson-Graziose, V., & Bryer, J. (2017). Assessing student perceptions of quality and safety education for nurses competencies in a baccalaureate curriculum. *Journal of Nursing Education, 6*(7), 436-438. https://dx.doi.org/10.3928/01484834-20170619-09

Pollard, M.L., Stapleton, M., Kennelly, L., Bagdan, l., Cannistraci, P., Millenbach, L. & Odondi, M. (2014). Assessment of quality and safety education in nursing: A New York State perspective. *Nursing Education Perspectives, 35*(4), 224-229. https://dx.doi.org/10.5480/13-1104.1

Sullivan, D.T., Hirst, D., & Cronenwett. L. (2009). Assessing quality and safety competencies of graduating prelicensure nursing students. *Nursing Outlook, 57*, 323-331. https://dx.doi.org/10.1016/j.outlook.2009.08.004

Tovar, E., Ossege, J., Farus-Brown, S., Zonsius, M. & Morrow, L. (2019). DNP program faculty and graduates' knowledge and use of QI and safety processes. *Nurse Educator, 45*(1), 11-16. https://dx.doi.org/10.1097/NNE.0000000000000677

COMMENTARY

Common Pitfalls in Conducting Quantitative Nursing Research: A Commentary and Suggestions to Facilitate Publication of Studies

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Abstract

Background: This article is a commentary on some of the common pitfalls that many researchers (including nurse researchers) experience when developing and implementing studies which impede their ability to publish their work.

Purpose: The goal is to provide a summary and recommendations to assist novice nurse researchers with respect to some aspects of methodology and statistical analyses that are often overlooked and limit the validity of studies' findings and the reliability of the results.

Discussion: Specific research design attributes, data management and analyses procedures are identified that can be used to improve a study's integrity and appeal to academic journals for publication.

Conclusion: This article attempts to assist nurse researchers of all levels and in a variety of capacities to improve the quality of research and the ability to publish their studies.

Keywords: Quantitative, Research, Methodology, Publication

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Common Pitfalls in Conducting Quantitative Nursing Research: A Commentary and Suggestions to Facilitate Publication of Studies

Introduction

This article is a commentary about some common quantitative research methodology issues that sometimes impede authors' manuscripts from being published, and to offer a summary and recommendations of ways to avoid those impediments. Quantitative research methodology is a broad and complicated topic. I have attempted to provide information that would be of interest to a wide audience of nurse researchers. For the novice researcher, I offer a basic overview of best practices with respect to research design and the types of statistical analyses that are usually employed. For the somewhat more experienced researcher, I discuss issues of rigor in research and statistics that might provide new insights. In addition, analytical standards change over time. For example, subjects are typically no longer deleted from samples due to missing data as 'a rule of thumb'.

This commentary is only meant to trigger the reader's interest and is not meant to be a complete discussion of any of the topics. Whole books have been written on many of the individual topics touched on in this article. You are referred to standard textbooks on quantitative research methodology and statistical analyses for further details.

Over the years, I have evaluated many research studies as a reviewer for a number of academic journals, a university dissertation advisor, and as a statistician providing analyses for nurse researchers in a variety of clinical and academic settings. As a result, I've observed some common patterns of errors that create difficulty in determining the results and having confidence in the outcomes. Sometimes, these errors result in the need for significant editing of the manuscript which is time-consuming, and in worst-case scenarios they invalidate the results making the manuscript unpublishable. So, it is best to start with a strong research plan. Once you have collected the data, it's nearly impossible to make major changes.

Observations and Recommendations

What are the most common research design problems that limit a study's ability to be published?

The following is a list and description of 9 common pitfalls.

1. The topic has been thoroughly researched and a new study is not likely to offer new or different findings.
2. The researcher attempts to create a study from previously collected data that was the result of a quality improvement project or poorly designed prior study. Quality improvement projects do not usually possess the rigor of a research study. They are important and necessary mechanisms to identify patient care improvement, but tend to not be designed with sufficient detail to control for a myriad of confounding factors and biases that a reliable and valid research design should contain. Although it is possible to produce a publishable retrospective research study from a quality improvement project, it is limited to those where study-level data has been obtained.
3. A study using previously collected data that has not followed Federal research human subjects protections, i.e., IRB review, data protection guidelines, confidentiality, etc. This is sometimes the result of performing retrospective chart reviews. Even though the patient had signed a consent for treatment, that doesn't automatically permit their clinical data to be used for research purposes unless it is stated in the consent that such might occur. Chart reviews require prior approval from the organization's Institutional Review Board (IRB) which is a Federal requirement of organizations where research is conducted.
4. Failure to obtain permission to conduct the research from the subjects' recruitment site, permission from the subjects (absence of an informed consent for research, or absence of IRB review), and permission from the authors to use the standardized measurement tools. The latter fall under copyright protection and cannot be used without permission unless it is clearly stated by the author in the publication that the tool can be used without the author's permission.
5. Another common mistake is that a researcher believes a certain scenario to be true and then tries to prove it. This generally leads to biased research. Research is an exploratory process. The proper technique is to identify all of the possible predictors of a particular factor of interest, collect data for all or most of them in a valid and reliable manner, and test the relationships using appropriate statistical analyses to identify which are true and which are not. The researcher should be prepared for unexpected results and faithfully report them, and not simply try to prove their original position.
6. The study is under-powered. This usually means that the sample size was too small or the type of data that was collected lacked sufficient precision to be able to identify significant relationships that are inherent in the research design [Type II statistical error] (Plichta & Kelvin, 2013). This situation may occur when the researcher hasn't performed a sample size estimation prior to data collection or hasn't been able to obtain enough participants to meet the quota of the estimated sample size. In addition, this may occur when the researcher chooses to perform a pilot study due to time or resource constraints. The most efficient way to perform research is to start with a solid design including an adequate sample size for the types of analyses to be conducted.
7. The study only provides descriptive statistics, i.e., means, standard deviations and range of values and doesn't analyze relationships among the variables. Although this type of study can be useful in understanding the prevalence of a situation or issue, it is not very informative with respect to the prediction of that situation. Consequently, this type of manuscript is generally not very competitive related to editors' decisions to publish, unless it is about a very unusual or under-researched topic.

8. The authors identify significant findings, but do not report the effect sizes. Although this may not affect the ability to get an article published, it does affect the implications for professional practice and for future research which needs to be carefully explained in the article in order to avoid requests for significant editing. The effect size is the magnitude of the relationship among the significant factors. A relationship can be statistically significant, but if the effect size is small, the finding may not have an impact [on practice] (Cohen, 1992; Pek & Flora, 2018; Warner, 2021).
9. The researchers create their own measurement tools without consideration of reliability and validity measurement, or use tools from published literature which do not have established reliability and validity (absence of psychometric analysis). I recommend using published standardized (reported psychometric statistics) tools whenever possible, except for the recording of the demographic questions which are typically semi-structured, specific to the study's population and developed by the researcher. I will further describe standardized measurement tools and psychometric analysis later in this paper.

How do I choose a topic to research?

Manuscripts that are most readily published are those that study a topic that will appeal to a large number of RNs in practice or in training, not just those in highly specialized settings or in research environments. Once you've identified a topic, the next step is to find a gap in the current knowledge which will provide an opportunity to contribute new information. Review the current literature and identify whether or not there is a gap. Do not conduct a study in an area that has been highly researched and published, unless there is evidence to refute the preponderance of findings in the literature due to a new piece of evidence, or you intend to conduct a meta-analysis.

Which research design is best with respect to publication?

There isn't a formula with respect to the best designs regarding publication. However, well-designed studies that have a high degree of validity of results and reliability in their measurement are among the most sought after by journals. The type of design will depend on the nature of the topic, the sample, the amount of time available to conduct the research and the availability of resources to collect data.

Overall, experiments and quasi-experiments are among the best types of healthcare studies with regard to the above. The next-best are correlational designs that control for confounding variables. Experimental designs possess the following characteristics.

a. One or more intervention groups
b. A control group
c. Randomized assignment of subjects to each of the groups
d. Pre and post measurements (longitudinal study) are preferred, if possible

A quasi-experimental design consists of the same characteristics, but lacks randomized assignment of subjects to the groups (Polit & Beck, 2017).

A type of experiment that is particularly valued for its high level of validity is the cross-over experimental design. This is an experiment in which there are two phases. Phase one is the standard approach with experimental and control groups. In phase two, the control group is exposed to the intervention and thereby becomes the new experimental group. Likewise, the previous experimental group is monitored in the absence of the intervention and becomes the new experimental group. If a significant result is found between the experimental and control groups no matter the timing of the findings (phase 1 or phase 2), it allows for a stronger conclusion of causality between the independent and dependent factors.

A correlational design differs in that it does not possess a control group. It consists of a single group and identifies the significant relationships among the relevant factors by using advanced statistical procedures such as regression analysis (Polit & Beck, 2012). Of note, the terms independent and dependent variables are reserved for research that employs an experimental design, i.e., possesses an intervention group(s), a control group, and randomized assignment to the groups. Correlational designs utilize the term predictor variable in place of independent, and criterion variable in place of dependent (Salkind, 2010).

Some Data Collection Considerations

Variables. It is important to identify all of the variables that might be related to the factor of interest (dependent variable), not just the ones that are most readily available. This is because most relationships are multifactorial and are not simple cause and effect situations. It is always necessary to conduct a thorough review of the literature and identify all of the factors that have been observed to be related to your dependent variable. Once you've assembled that list, you'll want to try to collect that data (in addition to the new variable(s) you hypothesize will be related) within your survey. These potentially related variables are identified as control variables and have the potential to create confounding effects within the analyses. A confounder is a variable that is not of central interest in the study, but has an effect on the independent and dependent variables (Meyers et al., 2017; Vander Weele & Shpitser, 2013). For example, a study of HgbA1c blood levels and a specific diet is likely to be confounded by age and BMI. Confounders are typically controlled through sampling strategies or regression analysis.

Randomization. There are a variety of approaches to randomizing the assignment of subjects to groups in experimental studies. Perhaps the easiest and most reliable is to assign each subject a number and then use a computer program that generates random numbers to select subjects for each of the groups. A readily available program is the RANDBETWEEN function in Microsoft™ Excel.

Sample selection. Pick a study population for which you are confident to obtain an adequate sample size. Anticipate that 20% – 30% of recruits will drop-out or not complete the data collection tool, providing only partial statistics for analyses. Oftentimes the completion rate is dependent on the length of time it takes to complete the survey (number of items or questions).

In terms of estimating the size of the sample that will be needed, the best approach is to use internet-based software. There are many free programs available. A commonly used one is G*Power

(Erdfelder et al., 1996). In order to calculate the estimated sample size, you'll need to anticipate the type of statistical test that will be used. You'll also need to enter the desired power, alpha level, effect size and whether you'll employ a one-tailed or two-tailed test. In nursing research, power, alpha level and effect size are typically set at 0.80, 0.05, and medium, respectively (Cohen, 1992). If you are only interested in one type of relationship, whether it be a positive or an inverse relationship, then a one-tailed test will maximize the power of your analyses. If you are interested in either type of significant relationship, select a two-tailed test.

Generalization. It's important for the reader to be able to generalize the results of your study to their own local populations or population of their interest. Be sure to collect enough demographic information to allow readers to relate the findings to populations other than your sample. As a guide, review articles of studies that have been conducted that are related to your research topic to see which demographic statistics are usually measured.

Standardized measurement tools versus researcher-constructed tools. Except for the demographic questions which are usually developed by the researcher, use standardized measurement tools whenever possible. This will control for various types of biases in the results and increase the readers' confidence in the reliability and validity of your findings. Standardized measurement tools are questionnaires that have been statistically tested to determine their ability to reproduce similar results under similar circumstances (reliability) and their ability to precisely measure the factor of interest (validity). Reliability is generally tested using a Cronbach alpha coefficient. Although there are various opinions, a minimum score of 0.70 is considered a reliable tool (Tavakol & Dennick, 2011).

Validity is measured in a number of ways. One of the most common is factor analysis. This technique looks for themes in the manner in which the subjects answered the data-gathering instrument in order to determine whether they are consistent with the overall objective of the tool. Each theme is defined as a factor and each factor generally is used to create a subscale within the tool. As long as each subscale has a Cronbach alpha of 0.70 and above, it can be analyzed as a unique variable in addition to the tool's overall score (Note that some scales do not have overall scores and only use the subscale scores for analysis). If the overall score of the tool has been found to be significant with another variable when testing your hypotheses, it is generally appropriate to also test the tool's subscale scores for significance.

Research question. The study should state a research question. It is a brief statement of the reason for your research study using general informal language in the form of a single question. This question is used to formulate the hypotheses.

Hypotheses. These are a series of simple statements indicating the expected relationships to be found among two or more variables. You will use statistical tests to confirm or reject each of the hypotheses in order to draw conclusions and to answer the research question. Most published studies contain 3 to 5 hypotheses.

Data Preparation and Statistical Analysis

When entering the statistics into a database from paper or computerized surveys, be sure that the scores are properly formatted. Mistakes frequently occur due to researchers not transposing the scores of negatively worded standardized measurement tool items or not performing some of the unique calculations some tools require. It's important to review a tool's scoring guidelines as published by its author to be sure that the results are accurate and can be compared to those of published studies that have used the same tool.

It is often useful to enter the statistics into a database that permits calculations such as Microsoft™ Excel, as opposed to entering the statistics directly into a statistical software program. Most programs usually have limitations in the way that data can be formatted or calculated. Once data have been entered into the database (such as Excel), you'll want to create several new variables. These are the overall scores and possibly the subscale scores for each of the tools. Within Excel, there is a feature to calculate the sum and the mean (depending on the tool's scoring guidelines) of strings of numbers in specific database cells; allowing for the creation of a column or columns of scores representing the overall (and subscale) scores for each of the tools. Once the statistics have been properly formatted for analysis within the database, it is a simple process to import the data into a statistical software program for analysis.

Determine the completeness of the data. It's not unusual for subjects to occasionally skip over a survey item or prematurely finish without providing responses to all the questions. In the past, incomplete cases (subject data) were simply removed from the analysis (casewise deletion). Current thinking is that removing cases distorts the findings and introduces bias with respect to the findings being representative of the sample. Most experts recommend replacing limited amounts of data whenever possible.

There are three types of missing data: (1) accidental or missing completely at random (MCAR); (2) unexpectedly missing where there are data that explain the missingness, known as missing at random (MAR); and, (3) deliberate omissions on the part of the subject or missing not at random (MNAR). MCAR is generally perceived to be due to human error and is characterized by non-systemic omissions (randomly missing). Missing data due to MCAR and MAR are generally replaced by the researcher as long as these are 10% - 20% of the statistics or less. The method to determine whether or not the missing values are MCAR or MAR is to look for patterns in the omissions. If none exist, you can assume it is MCAR; or if the patterns can be explained by a second variable, you can assume it is MAR. In both circumstances, you should substitute values (Ali et al., 2011).

The substitute data is an estimation of how the subject might have answered the question based on how they answered the other questions within that specific standardized measure. The best method to replace missing values is a procedure called multiple iteration. However, it requires specialized software that is usually unavailable to researchers outside of research institutions due to its cost. Other valid but less regarded procedures involve using linear interpolation which is part of many statistical software programs, or simply inserting the mean of the previous answered

scores within that tool or subscale. Each method has its strengths and weaknesses (Lang & Little, 2018).

When a pattern exists with regard to the missing values, i.e., a group of the subjects declined to answer a specific item, or they ceased answering, presumably due to fatigue or confusion about how to answer the question or item, then the missing data is considered missing not at random (MNAR). Since the omissions are the result of intent, data cannot be substituted. However, the subject or case would not be deleted. Instead, the data the subject had provided would be used in the analyses to the extent possible, bearing in mind that a tool's overall score might need to be calculated in an alternative manner since some of the values are missing, e.g., use of the means of the scores (not dependent on the number of answers) instead on the sums of the scores.

Evaluate the Normality of the Data Distributions. Normally distributed data follows established rules of probability resulting in more valid analyses and findings than skewed data (non-normally distributed). The evaluation of normality is a somewhat subjective process. Usually, normal distributions are bell-shaped when scores are plotted on the x-axis and the frequency of each of those scores on the y-axis. The mean and the median of the distributions are the same or at least very similar. The skewness statistic is typically between +1 and -1, and the kurtosis statistic is relatively close to 0. Often a histogram chart of the distribution is generated from the statistical software for examination to confirm a bell-shaped distribution. In addition, the Kolmogorov-Smirnov or Shapiro-Wilks tests may be employed with a p-statistic greater than 0.001 suggesting normality (Meyers et al., 2017). It is essential to evaluate the normality of the distributions of each group within a variable when performing between-group analyses, such as t-Tests and analyses of variance (ANOVA and ANCOVA), and not simply the overall scores for the measurement tool. Normal distributions do not always adhere to the above evaluation techniques and judgement needs to be employed. Most tests perform reasonably well in close-to-normally distributed situations with larger sample sizes (greater than 100). With smaller samples, caution should be exercised.

The determination of normality of the distribution informs the researcher as to the type of test to be performed. With a normally distributed criterion (dependent) variable, you should use a parametric test. Similarly a skewed or kurtotic distribution would require the use of a non-parametric test. When performing correlations or linear regression analysis, the normality of the data can be determined by viewing the normal Q-Q plot of the regression standardized residual. This can be obtained using most statistical software by performing regression analysis of the predictor and criterion variables. The data points in the plot should appear relatively close to the straight line which is the predicted value. Also, a scatter plot chart will be produced at the same time. If the data is normally distributed, the points should be scattered without any pattern (Meyers et al., 2017).

Testing Relationships among Variables

The first step when testing relationships among variables is to set the alpha level. This is the criterion by which to determine statistical significance. It is usually 0.05 in nursing research and significant results are documented as $p < 0.05$. Next, you'll need to test the criterion (dependent) variable against each of the demographic and other study variables to determine all that are significantly related, using univariate (such as ANOVA) and bivariate (such as Pearson correlation coefficients) tests. This will allow you to determine which variables are significantly related with respect to the variables to be tested in your hypotheses. These related variables, known as co-variates, may be confounders (see section on "Variables") and need to be controlled through the use of specific analytic techniques when testing the hypotheses.

At this stage of the analysis, it is typical to find multiple significant relationships. When co-variates have been identified, it is then necessary to analyze the data using analysis of covariance (ANCOVA) or multiple regression analysis. When performing the latter, the co-variates are entered into the analysis as a group of predictors in the first step of the analysis, and may be labelled control variables. In the following steps, the predictor variables related to the hypotheses being tested are entered. As a result, any of the significant relationships observed among the hypotheses tests will have been adjusted with respect to the influence of the control variables (potential confounders), providing more reliable and valid findings.

There are many free online statistical analysis platforms by which nurse researchers can conduct their own analyses, and a multitude of easy to read user-manuals are available. For some, however, it will be necessary to consult a statistician. It is usually helpful and cost effective to consult with the statistician when designing your study or at least your data collection survey in order to avoid some of the pitfalls that can complicate analyses. Many professional nursing organizations offer small research grants which are often enough to cover statistical analysis costs.

Discussion of Limitations

Within the discussion section, it is required to disclose the limitations of the study. If it a correlational design, the results cannot be interpreted to mean cause and effect. So, the interpretation of the findings can only assert that there is a relationship among the variables. Only an experimental design can imply causality. Other common limitations are biases in sample selection (representativeness of the population), large amounts of missing data, small effect size, and small sample size. In the latter situation, the most common type of error is one where significant relationships go unidentified. Another common limitation is subject response bias which is when subjects intentionally or unintentionally provide inaccurate information. This is often the result of subject fatigue due to surveys containing many questions and surveys that haven't been standardized resulting in ambiguous, confusing or inadvertently misleading items.

Summary

In summary, getting your research published can be a challenging task, but you can make the process easier by developing and conducting studies with excellent integrity. The intent of this article is to point out ways in which to develop a research manuscript that is readily publishable. The main focus is on study design, data management and statistical analysis which are generally not the strengths of most researchers. It is the intent

of the author that researchers of varying skill and experience will find these concepts useful. Finally, the reader is advised to refer to a textbook on clinical research methodology and statistical analysis for further details about the above topics.

References

Ali, A. M. G., Dawson, S. J., Blows, F. M., Provenzano, E., Ellis, I. O., Baglietto, L., Huntsman, D., Calda, C., & Pharoah, P. D. (2011). Comparison of methods for handling missing data on immunohistochemical markers in survival analysis of breast cancer. *British Journal of Cancer, 104*(4), 693–699. https://dx.doi.org/10.1038/sj.bjc.6606078

Cohen, J. (1992). A power primer. *Psychological Bulletin [PsycARTICLES, 112*(1). Retrieved from http://www2.psych.ubc.ca/~schaller/528Readings/Cohen1992.pdf

Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments, & Computers, 28*(1), 1–11. https://dx.doi.org/10.3758/BF03203630

Lang, K. M., & Little, T. D. (2018). Principled missing data treatments. *Prevention Science, 19*(3), 284–294. https://dx.doi.org/10.1007/s11121-016-0644-5

Meyers, L., Gamst, G., & Guarino, A. J. (2017). *Applied multivariate research: Design and interpretation* (3rd ed.). Sage Publications, Inc.

Pek, J., & Flora, D. B. (2018). Reporting effect sizes in original psychological research. *Psychological Methods, 23*(2), 208–225.

Plichta, S. B., & Kelvin, E. (2013). *Munro's statistical methods for health care research* (6th ed.). Wolters Kluwer/Lippincott, William & Wilkins.

Polit, D. F., & Beck, C. T. (2017). *Nursing research: Generating and assessing evidence for nursing practice* (10th ed.). Wolters Kluwer/Lippincott, William & Wilkins.

Salkind, N. (2010). *Encyclopedia of research design*. https://dx.doi.org/10.4135/9781412961288 NV - 0

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2*, 53–55. https://dx.doi.org/10.5116/ijme.4dfb.8dfd

Vander Weele, T. J., & Shpitser, I. (2013). On the definition of a confounder. *Annals of Statistics, 41*(1), 196–220. https://dx.doi.org/10.1214/12-AOS1058

Warner, R. M. (2021). *Applied statistics II: Multivariable and multivariate techniques* (3rd ed.). Sage Publications, Inc.

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